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NSF / ANSI 49 Biological Safety Cabinets • Animal Containment Workstations • Fume Hoods • Clean Benches

Labculture®

Class II, Type A2 Biological Safety Cabinets

User and Service Manual

Thank you for purchasing this Esco Biological Safety Cabinet. Please read this manual thoroughly to familiarize yourself with the many unique features and exciting innovations we have built into your new equipment. Esco provides many other resources at our website, www.escoglobal.com, to complement this manual and help you enjoy many years of productive and safe use of your Esco products.

User And Service Manual

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Labculture®

Class II, Type A2 Biological Safety Cabinets

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Esco LA2 User & Service Manual (Version 4)
Released 28 July 2008

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Table of Contents

Warranty Terms and Conditions ..... **v**
Introduction ..... **vii**
1. Products Covered vii
2. Safety Warning vii
3. Limitation Of Liability viii
4. European Union Directive on WEEE and RoHS viii
5. Symbols ix
Declaration Of Conformity ..... **xi**
About Esco Biological Safety Cabinets ..... **xiii**

User Section

1. Basic Product Information **1**
1.1 Quick view 1
1.2 Airflow pattern 2

2. Installation **3**
2.1 Pre-requisites 3
2.1.1 Selecting the Installation Location 3
2.1.1.1 The following requirements should be taken into account: 3
2.1.2 Preparing For Installation 6
2.1.2.1 Support Requirements 6
2.1.2.2 Exhaust Requirements 6
2.1.2.3 Electrical Requirements 6
2.1.2.4 Service Line Requirements 7
2.1.3 Optional Retrofit Kits 7
2.2 Exhaust Collar Installation 8
2.3 Drain Valve Installation 11
2.4 Cabinet Plumbing 12
2.5 Connecting The Cabinet 14
2.5.1 Connecting the Drain Valve 14
2.5.2 Connecting the Electrical Supply 14
2.5.3 Connecting the Service Fixture(s) 14
2.5.4 Connecting to an Exhaust System 15
2.5.5 Safety and Warning Labels 15
2.5.6 Preliminary Cleaning 15
2.6 Performance Validation / Certification 15
2.6.1 Disclaimer 15

3. Operating Your Cabinet **17**
3.1 Sentinel™ Control System Overview 17
3.2 Concept of Diferent Sash Window States 19
3.3 Starting The Cabinet 19
3.4 Working In The Cabinet 20
3.5 Working Ergonomics 22

3.6 Cleaning And Shutting Down The Cabinet 23
3.7 Menu Options 25
3.7.1 Settings (Clock, Timer and Units) 26
3.7.1.1 Set Clock (Time) 26
3.7.1.2 Warm Up Timer 26
3.7.1.3 Post Purge Timer 27
3.7.1.4 UV Timer 27
3.7.1.5 EXP Timer 28
3.7.1.6 Air Velocity Unit Selection 28
3.7.1.7 Temperature Unit Selection 29
3.7.2 Calibration 29
3.7.3 Administrator Access and Pin 30
3.7.3.1 New Admin PIN 30
3.7.3.2 New Fan PIN 30
3.7.3.3 A/F Monitor 31
3.7.3.4 Reset Blower Hour Meter 32
3.7.3.5 Reset UV Hour Meter 32
3.7.3.6 Reset Default 33
3.7.4 Setting the Mode 33
3.7.4.1 Normal Mode 33
3.7.4.2 Maintenance Mode 33

4. Maintaining Your Cabinet 35
Log Record 36

Service Section

1. Re-Certification And Maintenance By Service Personnel 39
1.1 Certification Flowchart 40
1.2 Airflow Adjustment 40
1.3 Damper Adjustment 41
1.4 Unit Re-certification 42
1.5 Calibration of Sentinel™ Control 49
1.5.1 Setting Cabinet to Maintenance Mode 49
1.5.2 Sensor Constant - Temperature Sensor Activation 50
1.5.3 Warming Up the Speed Control 50
1.5.4 Calibrating the Inflow Fail Set Point 50
1.5.5 Calibrating the Inflow Nominal Set Point 50
1.5.6 Calibrating the Downflow Nominal Set Point (downflow velocity) 51
1.5.7 Setting Cabinet back to Normal Mode, and Final Checking 51
1.6 Replacement of Filters 52
1.7 Replacement of Blower 53
1.8 Replacement of Airflow Sensor 55
1.9 Replacement of Sash Glass 56
1.10 Replacement of Flourescent Lamp and UV Lamp 57

1.11 Decontamination Procedure....57
1.11.1 Warning on Formalin Exposure....58
1.11.2 Common List of Equipment Used....58
1.11.3 Appropriate Protective Clothing....58
1.11.4 Common Apparatus....59
1.11.5 Common Preparatory Steps....59
1.11.6 Decontamination Process....60
1.11.6.1 Formaldehyde - Ammonia Combination....60
1.11.6.2 Paraformaldehyde - Ammonium Bicarbonate Combination....62
1.11.7 Completion Steps....64
1.11.8 Validation of Decontamination Procedure (Optional)....64

2. Troubleshooting....65
2.1 Hardware and Software Troubleshooting....65
2.1.1 Hardware Troubleshooting....65
2.1.2 Software Troubleshooting....88
2.2 Operation Mode Summary....93

3. Product Specification....95
3.1 LA2 Engineering Details....95
3.2 LA2 (A-Series) - 230 V Cabinets Technical Specification Summary....97
3.3 LA2 (A-Series) - 115 V Cabinets Technical Specification Summary....98
3.4 LA2 (L-Series) Technical Specification Summary....99
3.5 Electrical Schematic Drawing For 220-240V, AC, 50/60 Hz Variant (LA2-_A1/3)....101
3.6 Electrical Schematic Drawing For 220-240V, AC, 50/60 Hz Variant (LA2-_L1/3)....103
3.7 Electrical Schematic Drawing For 220-240V, AC, 50/60 Hz Variant (LA2-_A1/3-M)....105
3.8 Electrical Schematic Drawing For 220-240V, AC, 50/60 Hz Variant (LA2-_L1/3-M)....107
3.9 Electrical Schematic Drawing For 110-130V, AC, 60 Hz Variant (LA2-_A2)....109
3.10 Environmental and Electrical Requirements....111

Replacement Parts List (Standard)....113
Replacement Parts List (Motorized Window)....117

Appendix

A. Further Information and Reference Materials....123
B. Log Record....125

WARRANTY TERMS AND CONDITIONS

Esco warrants that this equipment will perform according to specifications for 3 years from the date of purchase.

Esco's limited warranty covers defects in materials and workmanship. Esco's liability under this limited warranty shall be, at our option, to repair or replace any defective parts of the equipment, provided if proven to the satisfaction of Esco that these parts were defective at the time of being sold, and that all defective parts shall be returned, properly identified with a Return Authorization.

This limited warranty covers parts only, and not transportation/ insurance charges.

This limited warranty does not cover:

√ Freight or installation (inside delivery handling) damage. If your product was damaged in transit, you must file a claim directly with the freight carrier.
√ Products with missing or defaced serial numbers
√ Products for which Esco has not received payment
√ Problems that result from:

¤ External causes such as accident, abuse, misuse, problems with electrical power, improper operating environmental conditions
¤ Servicing not authorized by Esco
¤ Usage that is not in accordance with product instructions
¤ Failure to follow the product instructions
¤ Failure to perform preventive maintenance
¤ Problems caused by using accessories, parts, or components not supplied by Esco
¤ Damage by fire, floods, or acts of God
¤ Customer modifications to the product

√ Consumables such as filters (HEPA, ULPA, carbon, pre-filters) and fluorescent / UV bulbs

Factory installed, customer specified equipment or accessories are warranted only to the extent guaranteed by the original manufacturer. The customer agrees that in relation to these products purchased through Esco, our limited warranty shall not apply and the original manufacturer's warranty shall be the sole warranty in respect of these products. The customer shall utilise that warranty for the support of such products and in any event not look to Esco for such warranty support.

Esco encourages all users to register their equipment online at www.escoglobal.com/warranty or complete the warranty registration form included with each product.

ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN TIME TO THE TERM OF THIS LIMITED WARRANTY. NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER THE LIMITED WARRANTY PERIOD HAS EXPIRED. ESCO DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES PROVIDED FOR IN THIS LIMITED WARRANTY OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, ANY LIABILITY FOR THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES, FOR PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST WORK. ESCO'S LIABILITY WILL BE NO MORE THAN THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. THIS IS THE MAXIMUM AMOUNT FOR WHICH ESCO IS RESPONSIBLE.

These Terms and Conditions shall be governed by and construed in accordance with the laws of Singapore and shall be subject to the exclusive jurisdiction of the courts of Singapore.

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Global Email Helpdesk: support@escoglobal.com

Visit **http://www.escoglobal.com/** to talk to a Live Support Representative
Distributors are encouraged to visit the Distributor Intranet for self-help materials.

Policy updated on 30th Jan 2007 *(This limited warranty policy does not apply to products purchased before 30th Jan 2007).*

INTRODUCTION

1. PRODUCTS COVERED

This manual is applicable and specific to the following Esco products.

Electrical	Nominal Size			
	0.9 meters (3')	1.2 meters (4')	1.5 meters (5')	1.8 meters (6')
220-240V, AC, 50Hz, 1Ø	LA2-3A1	LA2-4A1	LA2-5A1	LA2-6A1
220-240V, AC, 50Hz, 1Ø	LA2-3A1-M	LA2-4A1-M	LA2-5A1-M	LA2-6A1-M
110-130V, AC, 60Hz, 1Ø	LA2-3A2	LA2-4A2	LA2-5A2	LA2-6A2
110-130V, AC, 60Hz, 1Ø	LA2-3A2-M	LA2-4A2-M	LA2-5A2-M	LA2-6A2-M
220-240V, AC, 60Hz, 1Ø	LA2-3A3	LA2-4A3	LA2-5A3	LA2-6A3
220-240V, AC, 60Hz, 1Ø	LA2-3A3-M	LA2-4A3-M	LA2-5A3-M	LA2-6A3-M
220-240V, AC, 50Hz, 1Ø	LA2-3L1	LA2-4L1	LA2-5L1	LA2-6L1
220-240V, AC, 50Hz, 1Ø	LA2-3L1-M	LA2-4L1-M	LA2-5L1-M	LA2-6L1-M
220-240V, AC, 60Hz, 1Ø	LA2-3L3	LA2-4L3	LA2-5L3	LA2-6L3
220-240V, AC, 60Hz, 1Ø	LA2-3L3-M	LA2-4L3-M	LA2-5L3-M	LA2-6L3-M

Note:

1. The A - Series (LA2-_A1) (220-240V, AC, 50Hz, 1Ø) are designed to comply with the European EN 12469 requirements.

2. The L - Series (LA2-_L1) (220-240V, AC, 50Hz, 1Ø) are designed to comply with the European EN 12469 requirements.

2. SAFETY WARNING

- Anyone working with, on or around this equipment should read this manual. Failure to read, understand and follow the instructions given in this documentation may result in damage to the unit, injury to operating personnel, and / or poor equipment performance.
- Any internal adjustment, modification or maintenance to this equipment must be undertaken by qualified service personnel.
- The use of any hazardous material in the cabinet must be monitored by an industrial hygienist, safety officer or some other suitably qualified individual.
- Explosive or inflammable substances should never be used in the cabinet unless a qualified safety professional has evaluated the risk involved.
- If chemical, radiological or other non-microbiological hazards are being used in the cabinet, additional protective measures should be taken. Besides that, the operation should be monitored by a suitably trained individual.
- The biological symbol (shown alongside) on the front panel of the cabinet indicates the presence of biological substances that pose a threat to human health.

- This cabinet is suitable for agents classified under biological safety levels 1, 2 and 3.
- For use of biological safety level 4 agents in the cabinet, the agents should be placed in a negative pressure area. Please note that while doing so, the operator should be wearing a full body positive pressure isolation suit.

- This cabinet should not be used with cytotoxic substances unless it has been determined that the filter can be safely changed.

  NB: *Cytotoxic substances cannot be inactivated by conventional formaldehyde decontamination*

- Before you proceed, you should thoroughly understand the installation procedures and take note of the environmental/electrical requirements of the cabinet
- In this manual, important safety related points will be marked with this symbol.
- If the equipment is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

3. LIMITATION OF LIABILITY

The disposal and / or emission of substances used in connection with this cabinet may be governed by various local regulations. Familiarization and compliance with any such regulation are the sole responsibility of the users of the cabinet. Esco's liability is limited with respect to user compliance with such regulations.

4. EUROPEAN UNION DIRECTIVE ON WEEE AND RoHS

The European Union has issued two directives:

- **Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)**

The objective of the WEEE directive is to promote "… the reuse, recycling and other forms of recovery of such wastes (WEEE) so as to reduce the disposal of waste besides improving the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers…" and hence this directive refers to the disposal of this cabinet within the EU. A "wheelie bin" sticker (shown alongside) has to be paste on all products covered by this directive, indicating that at the time of disposing of the product, it should not be grouped together with general unsorted municipal waste. Instead, distributors of electrical and electronic equipment should be responsible for the collection and scrapping of the products they have sold. Please note that this cabinet has been classified as "fixed industrial equipment" and hence the WEEE directive is not applicable to its disposal. You may, at the time of disposing this cabinet, still contact your local Esco distributor who can arrange for collection and recycling of this cabinet for a reasonable fee.

- **Directive 2002/95/EC on Restriction on the use of Hazardous Substances (RoHS).**

With respect to the directive on RoHS, please note that this cabinet falls under category 9 (monitoring and control instruments) and is therefore exempted from requirement to comply with the provisions of this directive.

5. SYMBOLS

Information in this manual may be prefaced with the following symbols. They are provided to help you identify important operational, safety, maintenance or conformance issues.

	Electrical Hazard: Danger of electric shock
	Turn Off And Disconnect From Main Supply Before Proceeding: Do not perform this operation while the unit is operational
	The Biohazard Symbol on the front panel of the cabinet indicates the presence of biological substances that pose a threat to human health
	Important Information: Read and understand before proceeding. Important safety related points will be marked with this symbol
	Approved Service Engineer Only: Operation to be performed only by approved engineer

Declaration of Conformity *

In accordance with EN 45014:1998

We, **Esco Micro Pte Ltd**
based at 21 Changi South Street 1
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Tel: +65 65420833
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declare on our sole responsibility that the product:

Equipment : Biological Safety Cabinet
Model : Labculture Class II (LA2-3A_,LA2-4A_,LA2-5A_,LA2-6A_)
(LA2-3A_-M ,LA2-4A_-M ,LA2-5A_-M ,LA2-6A_-M)
(LA2-3L_, LA2-4L_,LA2-5L_,LA2-6L_)
(LA2-3L_-M , LA2-4L_-M ,LA2-5L_-M ,LA2-6L_-M)

in accordance with the following directives:

- **2006/95/EEC : The Low Voltage Directive and its amending directives**
- **89/336/EEC : The Electromagnetic Compatibility Directive and its amending directives**

has been designed to comply with the requirements of the following Harmonized Standard:

- **Low Voltage : EN 61010-1 (2001)**
- **EMC : EN 61326-1 (2002) Class B**
- **Design/ Performance Criteria : EN 12469 (2000) Class II Biological Safety Cabinet**

More information may be obtained from Esco's authorized distributors located within the EU. A list of these parties and their necessary contact information is available on request from Esco.

Lim Lay Yew
Chief Executive Officer

* Applicable only to 220-240V, AC, 50 Hz cabinets

ABOUT ESCO BIOLOGICAL SAFETY CABINETS

Biological safety cabinet plays a significant role in many pharmaceutical, clinical, microbiological and industrial laboratories. Its basic function is to protect the operator and the environment from biological hazards that would otherwise pose a threat to human life during microbiological work.

At Esco, we encourage customers to learn more about the functions and operating principles of the biological safety cabinets available in the market today. We believe this will help you choose the cabinet that is most suitable for your specific needs.

MAJOR INTERNATIONAL STANDARDS

International standards play an important role in harmonization and ensuring that cabinets meet established industry guidelines for safety and performance. Consequently, you should understand the scope and application of these standards. The following tables detail some common international standards:

The different nomenclature used by various standards and the inflow requirement

Standard origin	The standard nomenclature	Minimum inflow requirement (m/s)
NSF / ANSI 49	USA Class II Type A1	0.38
NSF / ANSI 49	USA Class II Type A2	0.50
JIS K 3800:2000	Japan Class II Type A/B3	0.40 (Type A) / 0.50 (Type B3)
EN 12469:2000	European Union Class II	0.40
AS 2252	Australia Class II	To pass air barrier test

Biosafety Level (BSL)

	Lethality	Medium	Cure	Example
1	Safe	Liquid	Yes	Bacillus Subtilis
2	Some	Liquid	Some	HIV
3	Serious	Airborne	Some	TBC
4	Extreme	Airborne	None	Ebola

Name / Number	Governing Body	Referenced
NSF / ANSI 49	The National Sanitation Foundation (NSF) International (http://www.nsf.org/)	US / Global
Notes: Standard 49 has been widely adopted not only in the United States but also around the world.		Applies to / Covers: Class II biological safety cabinets
Name / Number	**Governing Body**	**Referenced**
EN 12469:2000	International Organization for Standardization (http://www.iso.org)	EU / Global
Notes: The European Norm 12469 is the latest international standard developed as a direct consequence of the European Union's harmonization efforts. It replaces previous standards such as the German standard DIN 12950, the British standard BS 5726 and the French standard NF X44-201. The EN 12469:2000 has been adopted officially as a national standard in all member nations of the EU.		Applies to / Covers: Class I biological safety cabinets Class II biological safety cabinets Class III biological safety cabinets
Name / Number	**Governing Body**	**Referenced**
AS 2252	Standards Australia (http://www.standards.com.au/)	Australia / New Zealand
Notes: The AS 2252 is the Australian standard for biological safety cabinetry. It has also largely been adopted as a national standard in nearby New Zealand. It applies to both Class I and Class II cabinetry with a focus on cabinet construction, design and performance. Australian standard cabinets incorporate twin blowers and are largely different from European and American "type" models.		Applies to / Covers: Class I biological safety cabinets Class II biological safety cabinets

Name / Number	Governing Body	Referenced
JIS K 3800:2000	Japanese Industrial Standards Committee (http://www.jisc.go.jp/eng/)	Japan
Notes: The JIS K 3800 was derived from the NSF49, and used only in Japan. Just like NSF 49, JIS K 3800 only applies to Class II biological safety cabinets.		Applies to / Covers: Class II biological safety cabinets

BIOLOGICAL SAFETY CABINET SUMMARY TABLE OF FEATURES

Class (Type)	Biosafety Level	Protection Offered		Min. Inflow Velocity	Recirc. Air	Exhaust Air	Contaminated Plenum Surrounded By	Exhaust Alternatives
		Operator	Product					
I	1 2 3	✓	×	0.38 m/s / 75 fpm	0%	100%	Outside air (Lab room)	Inside room / Hard Duct
	• Basic design and feature set • Unfiltered room air flows into the cabinet, passes through the workzone and then through a filtration system, trapping airborne contaminants. Clean, decontaminated air is exhausted from the cabinet. • The scope and application of Class I cabinets is limited and it is largely considered obsolete.							
II A1	1 2 3	✓	✓	0.38 m/s / 75 fpm	70%	30%	Outside air (Lab room)	Inside room / Thimble Duct
	• Room air enters the cabinet through a front inlet grille and is filtered before entering the workzone, contaminated air is passes through a filtration system trapping airborne contaminants. Clean, decontaminated air is recirculated through the workzone or exhausted from the cabinet. • Type A1 cabinets have a positively-pressurized plenum bordering the ambient environment. • Type A1 is now largely considered obsolete							
II A2	1 2 3	✓	✓	0.50 m/s / 100 fpm	70%	30%	Negative pressure	Inside room / Thimble Duct
	• Negative pressure surrounds the positively pressurized contaminated plenum providing added protection in the case of a leak in the positively pressurized plenum. • Most European, Japanese, and Australian Class II cabinets have airflow recirculation and exhaust ratios similar to Class II Type A2 cabinet along with the negative pressure isolated plenum operating in the same principle as the NSF Class II Type A2, but with lower inflow velocity requirement.							
II B1	1 2 3	✓	✓	0.50 m/s / 100 fpm	30%	70%	Negative pressure	Hard duct only
	• Type B1 cabinets also have a dedicated exhaust feature for work done inside the cabinet towards the back. • Toxic chemicals should only be used if they do not interfere with work when re-circulated in the downflow. • Type B1 cabinets have largely been replaced by Type B2, they are now generally considered obsolete.							
II B2	1 2 3	✓	✓	0.50 m/s / 100 fpm	0%	100%	Negative pressure	Hard duct only
	• Type B2 cabinets exhaust all inflow and downflow air after HEPA filtration to the external environment. • Type B2 cabinets are suitable for work with toxic chemicals used as an adjunct to microbiological processes. • Type B2 cabinets may be considered to be the safest of all Class II biological safety cabinets in the sense that the total exhaust feature acts as a fail-safe against downflow and/or exhaust HEPA filtration malfunction. However, the cabinet requires a stable building exhaust system that is precisely tuned to the cabinet airflow requirements.							
III	1 2 3 4	✓	✓	P>125 Pa P>0.5"WG	0%	100%	Negative pressure	Inside room / Hard Duct
	• Class III cabinets are usually of welded metal construction and are designed to be gastight. • Work is performed through glove ports in the front of the cabinet. • During routine operation, negative pressure relative to the ambient environment is maintained within the cabinet. • Class III cabinets provides product protection and prevent cross-contamination of samples. • Exhaust air is usually HEPA filtered and incinerated. Alternatively, double HEPA filtration with two filters in series may be utilized. • Class III cabinets usually exhaust air back to the laboratory, air may also be exhausted to the external environment. • When a dedicated ductwork system is employed, they are suitable for working with toxic chemicals as an adjunct to microbiological processes. • All Class III biological safety cabinets are suitable for work with microbiological agents assigned to biological safety levels 1, 2, 3 and 4. They are frequently specified for work involving the most lethal biological hazards.							

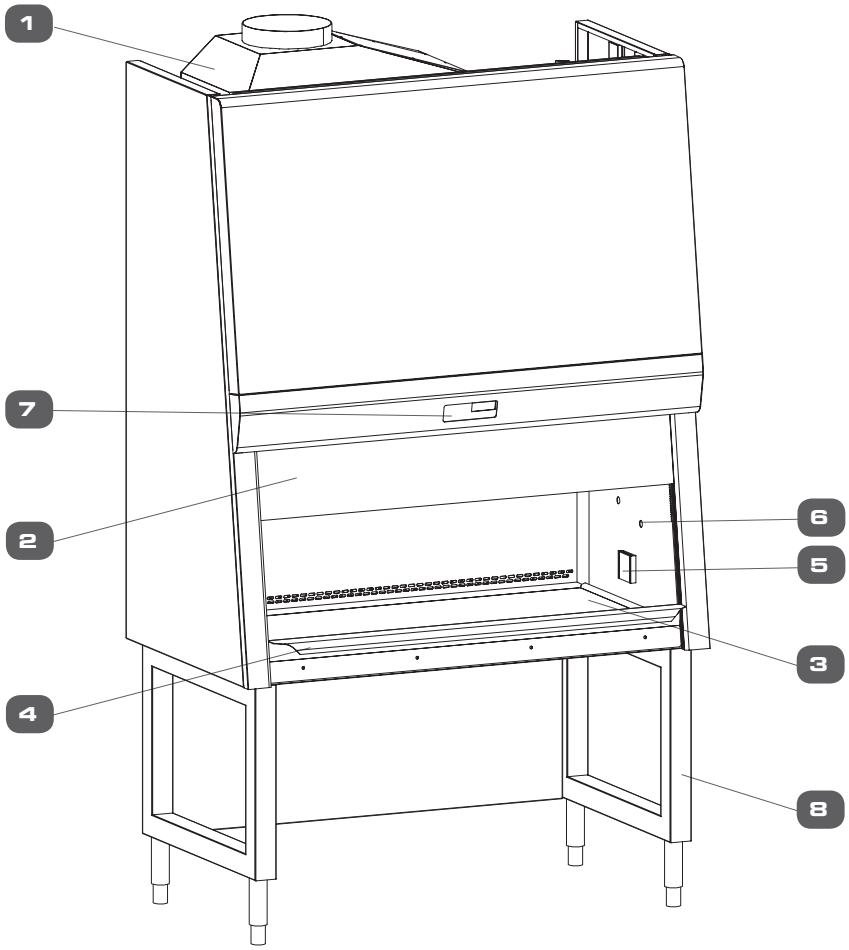
FURTHER INFORMATION

For further information on the topics discussed above, we have many documents available at www.escoglobal.com. Here you will find the most up-to-date information in far more detail than is possible to include in this manual.

USER SECTION

CHAPTER 1
BASIC PRODUCT INFORMATION

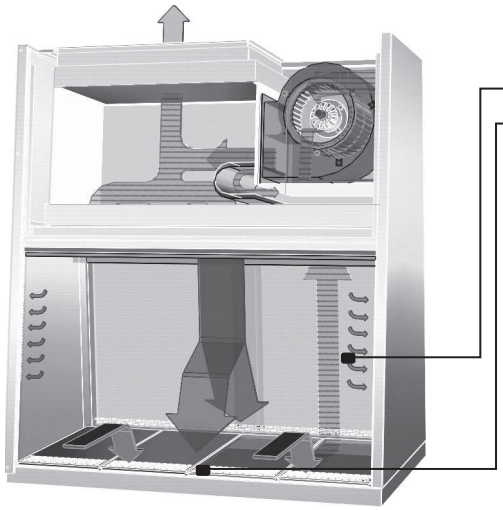
1.1 QUICK VIEW



1. Optional Exhaust Collar for Thimble-ducting
2. Frameless, shatterproof sash is easier to clean, offers larger, unobstructed viewing area.
3. Interior work area formed from a single piece of stainless steel with large radius corners to simplify cleaning.
4. Raised armrest maintains safety by preventing blockage
5. Universal electrical outlet
6. Service fixtures (offset for easier reach)
7. Esco Sentinel microprocessor supervises all cabinet functions. The control panel is located on the center of the cabinet, and angled down for easy access by the operator.
8. Optional support stand (with leveling feet shown, other types and options are available).

Class II cabinets provide product, operator and environmental protection. They are suitable for general microbiological work with agents classified under biological safety levels 1, 2 or 3.
(For more details please refer to www.escoglobal.com).

1.2. AIRFLOW PATTERN



- ULPA - filtered air
- Unfiltered / potentially contaminated air
- Room air / inflow air

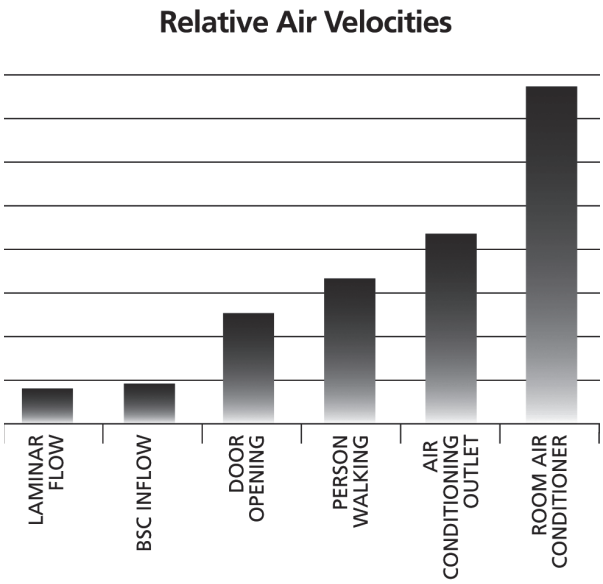
- Ambient air is pulled through the perforations located towards the work zone front to prevent contamination of the work surface and work product. The inflow does not mix with the clean air within the cabinet work zone. Inflow air travels through a return path toward the common air plenum (blower plenum) at the top of the cabinet.
- Approximately 37% for **LA2-_A_/ LA2-_A_-M** (30% for **LA2-_L_/ LA2-_L_-M**) of the air in the common plenum is exhausted through the ULPA filter to the room. The remaining 63% for **LA2-_A_/ LA2-_A_-M** (70% for **LA2-_L_/ LA2-_L_-M**) of the air is passed through the downflow ULPA filter and into the work area as a vertical laminar flow air stream bathing the work surface in clean air.
- The uniform, non-turbulent air stream protects against cross contamination within and throughout the work area.
- Near the work surface, the downflow air stream splits with a portion moving toward the front air grille, and the remainder moving to the rear air grille. A small portion of the ULPA filtered downflow enters the intake perforations at the side capture zones at a higher velocity.
- A combination of inflow and downflow air streams forms an air barrier that prevents contaminated room air from entering the work zone, and prevents work surface emissions from escaping the work zone.
- Air returns to the common air plenum where the 37% exhaust for **LA2-_A_/ LA2-_A_-M** (30% for **LA2-_L_/ LA2-_L_-M**) and 63% recirculation process for **LA2-_A_/ LA2-_A_-M** (70% for **LA2-_L_/ LA2-_L_-M**) is continued.

CHAPTER 2
INSTALLATION

2.1 PRE-REQUISITES

2.1.1 Selecting the Installation Location

Location impacts the nature and extent of external airflow disturbances, which may affect performance of the cabinet.



As can be seen in the graph, your cabinet's internal airflow velocity is relatively small compared to the airflow disturbances potentially caused by the opening of a door, a person walking by or for that matter being exposed to an air-conditioning outlet. All these things can therefore affect the proper functioning of a biological safety cabinet, thereby impairing the protection offered by the cabinet to both the operator and the samples placed inside it.

When installing the cabinet, it should be located as far away as possible from the above-mentioned sources of airflow disturbance and in an orientation which optimally shields the cabinet's internal airflow from all external airflow disturbances. Please note that the cabinet should not be placed close to another cabinet.

Fig. 1 *Relative air velocities of airflow disturbances*

2.1.1.1 The following requirements should be taken into account:

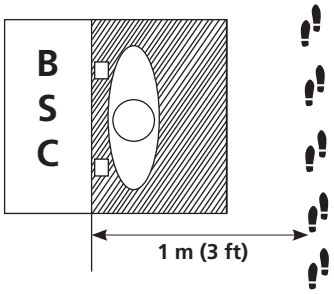
a. Poor siting of a cabinet can adversely affect performance. A specialist engineer should be consulted on correct positioning of the cabinet prior to installation.

b. Cabinets should never be sited in line with a doorway, an openable window, or adjacent to a thoroughfare. Care should be taken to ensure that possible disturbances to airflow such as room air diffusers, fans, extractors, vents, etc. are taken into account and any risk of disturbance noted and mitigated before installation.

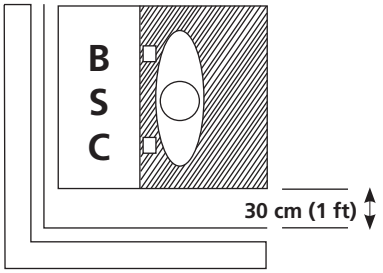
c. Room air supply diffusers should not be within 1.5 metres (5′) of the front aperture. If there are large numbers of cabinets in a laboratory this recommendation may be difficult to comply with, but where diffusers have to be placed in close proximity to a safety cabinet, their discharge velocities and the force air handling rates will need to be low.

d. The position of a safety cabinet should satisfy the spatial requirements (e.g. vision, lighting and convenience of access) of the operator and people working nearby. If the cabinet is installed on a bench top, the leading edge should slightly overhang or be flush with the edge of the bench top.

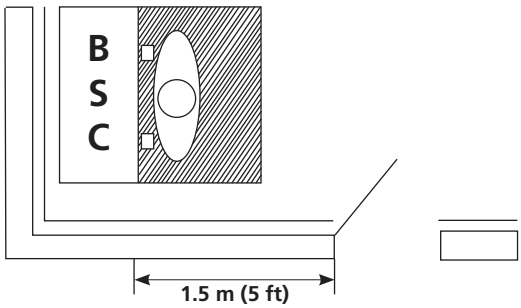
e. There should not be an open space between the leading edge of the cabinet and the front of the bench as this may create turbulence in front of the aperture. It also provides an obstacle which could adversely affect airflow across the cabinet face.



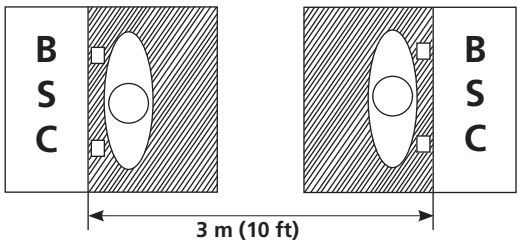
Any pedestrian traffic routes, thoroughfares or walkways should be at least 1.0 metre (3') from the front of the cabinet, so as to preserve a zone undisturbed by anyone other than the operator.



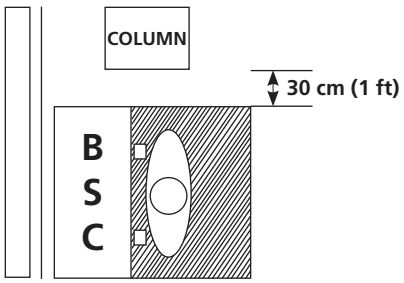
You should not position the cabinet with either side closer than 30cm (1') to adjacent walls or other similar obstructions. Allow at least 30cm (1') clearance on both sides of the cabinet. There should be adequate space left for cleaning the sides of the cabinet and for carrying out decontamination procedures. There should be unobstructed access to the main power supply point(s).



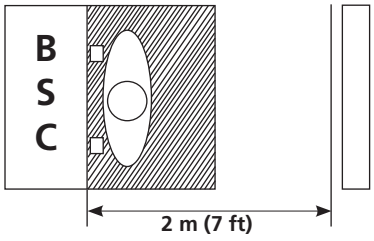
You should not position the cabinet where the distance between the aperture and any doorway is less than 1.5 metres (5') or the distance between the side panel and any doorway is less than 1.0 metre (3'). Door openings cause substantial air turbulence. If the door is fitted with air transfer grills, operator protection factor testing may be carried out to determine suitable reduced clearance.



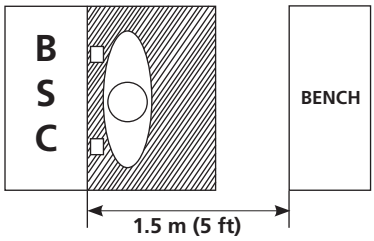
Safety cabinets should not be installed in positions where there is a likelihood of interference from other laboratory equipment. The distance from the aperture to the aperture of an opposing cabinet, fume cupboard, etc. should be in excess of 3 metres (10') for safe operation.



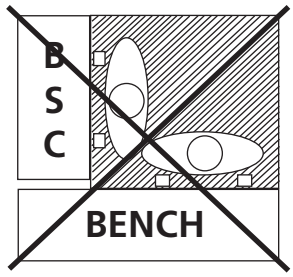
As with walls, any large obstruction such as a pillar or column projecting beyond the plane of the front aperture should not be within 30 cm (1') of the sides of the cabinet.



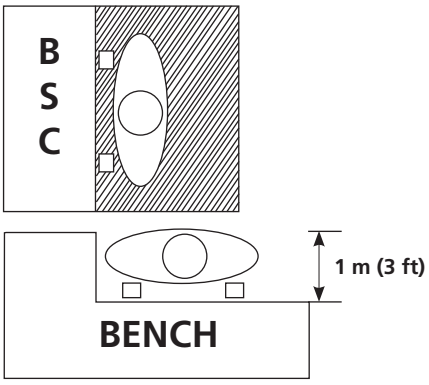
You should not position the cabinet in a location where there is an opposing wall (or other obstruction likely to affect airflow) within 2 metres (7') of the front aperture.



The distance between the aperture of the cabinet and the front of a bench opposite should not be less than 1.5 metres (5'). Containment performance may not be affected if this distance is reduced, to allow the operator to use the bench whilst working in the cabinet for instance. You should measure any such effects using relevant operator protection factor tests to determine safety limits.



Avoid positioning a bench at right angles to the cabinet. Whilst this may reduce traffic in front of the cabinet, any other person working at the bench is likely to disturb airflow close to the cabinet.



A projecting bench will help minimize traffic in front of the cabinet and anyone working at the bench is unlikely to have a significant effect on the airflow as long as the front of the bench is situated at least 1 metre (3') from the side of the cabinet.

2.1.2. Preparing For Installation

2.1.2.1 Support Requirements

Esco provides a number of support stand options, these are summarized below.

- Fixed height
- Telescoping height
- Infinitely adjustable cradle stand

Esco support stand with leveling feet is recommended for biological safety cabinets. It is recommended that the installation of the support stand be carried out by qualified personnel (contact your Esco Distributor for assistance).

After installation of the cabinet on the support stand with leveling feet, using a level placed in the centre of the work tray, adjust the legs to achieve a level work surface. First level from left to right and then from front to back. The NSF approved leg levelers provide a maximum of 50mm (2") adjustment.

Two persons would be needed for assembling the support stand as it is quite heavy.

Should the cabinet be relocated after the initial installation, take all the necessary precautions as the cabinet is very heavy.

If the cabinet is not installed on Esco's optional support stand, Esco can not guarantee cabinet's resistance against tipping and hence the user would be solely responsible for ensuring that the cabinet is securely fastened to third party stand or table.

The use of non-leveling feet Esco support stand will nullify the third party certification (NSF or TÜV) that the cabinet may have, because only Esco leveling feet support stand was used during certification.

While installing the cabinet onto an existing work surface, ensure that the structure can safely support the combined weight of the cabinet and any related equipment. Some modifications to the work surface may be necessary.

The work surface should be smooth, nonporous and resistant to those disinfectants and chemicals, to which the cabinet is regularly exposed.

2.1.2.2 Exhaust Requirements

The exhaust filter area is especially susceptible to disruptive air currents or air drafts. A clearance of at least 30 cm (1') is recommended between the highest point of the cabinet and the ceiling. If the distance is less than 30 cm (1'), the airflow alarm system may need re-calibration. In fact, for proper exhaust filter leak scanning purposes, a minimum clearance of 50 cm (1'8") is recommended.

If you intend to connect your cabinet to an external exhaust system, Esco offers an optional Exhaust Collar for Thimble-Ducting. Installation requirements and instructions are provided with the Exhaust Collar.

2.1.2.3 Electrical Requirements

The cabinet should be connected to its own dedicated power outlet(s).

The power rating for each model is shown in Section 3.10. Environmental and Electrical Requirements in the Product Specification Section. Ensure that the outlet is rated accordingly.

The power cable is located on the right hand side of the cabinet and the cord is 2.5m long. When preparing the installation site try to ensure the outlet is located to the right of the cabinet for ease of access.

2.1.2.4 Service Line Requirements

All service lines should be installed by a suitably qualified and certified engineer, in accordance with all applicable local, state and government regulations.

Service line attachments should be equipped with an emergency shut off valve that can be accessed quickly and with ease, should the need arises.

You should check with your local service installer as to whether there is a need to install pressure regulators to reduce the line pressure.

Your cabinet can accommodate service fixtures on the left or right hand side of the cabinet. Make allowance for the positioning of service lines when planning the installation site to ensure ease of access to emergency shut off valves.

2.1.3 Optional Retrofit Kits

Full instructions for optional retrofit kits are included with the kit. Please refer to the manual that accompanies the kit for installation instructions. Following is a list of retrofit kits available for this unit, you may also want to visit www.escoglobal.com for more information.

Accessories and Options

Esco offers a variety of options and accessories to meet local applications. Contact Esco or your local sales representative for ordering information.

Accessory / Option	Description
Electrical Outlets and Utility Fittings	• Electrical outlet, ground fault, North America • Electrical outlet, Europe/Worldwide • Petcock(air,gas,vacuum)-North America(American) style-Europe/Worldwide style DIN 12898, DIN 12919, DIN 3537
Support Stands	• Fixed height, available 711 mm (28”) or 864 mm (34”), ±38.1 mm (1.5”)- With leveling feet- With casters
	• Adjustable height, hydraulic range from 711 mm to 864 mm (28” to 34”)-With leveling feet - With casters
	• Telescoping height stand for leveling feet, nominal range 660 mm or 960 mm (26” or 37.8”)
	• Telescoping height stand for casters, nominal range 660 mm or 880 mm (26” or 34.6”) - Adjustable in 25.4 mm (1”) increments
	• Cradle stand, electrical hydraulic, infinitely adjustable, with casters - Elevates to seating or standing work surface height. - When lowered permits movement through standard doorway. **Note:** *Increases exterior dimensions.*
Cabinet Accessories	• PVC armrest- Chemically treated, improves operator comfort, easy-to-clean. 712 mm (28”) standard size.
	• Ergonomic lab chair- Laboratory grade construction,meets Class 100 cleanliness; alcohol resistant PVC materials - Adjustable 395-490 mm (15.6”-19.3”)
	• Germicidal UV lamp - Controlled by automatic UV lamp timer through Sentinel microprocessor control panel - Emission of 253.7 nanometers for most efficient decontamination - Lamp is positioned away from operator’s line-of-sight for safety and proper exposure to interior surfaces. **Note:** *UV lamp intensity reduces over time and its effectiveness is subject to factors such as relative humidity in the cabinet, ambient air temperature and microbial species in he work zone.* **Safety warning:** *Avoid UV exposure to eyes and skin. Ensure the sash is fully closed before UV lamp is switched ON.*
	• Ergonomic foot rest - Angled, helps maintain proper posture - Adjustable height - Anti-skid coating, chemical resistant finish
	• IV Bar, with hooks - Stainless steel construction - Available for all standard cabinets
	• Microscope viewing device - Mounting and viewing pouch integrated into sash. Factory installed; specify when ordering.

2.2 EXHAUST COLLAR INSTALLATION

Note : *Please check which type of damper that you have. For older cabinet with the old style damper, please contact Esco or your local distributor for a retrofit kit. For new cabinet with the staggered damper, please proceed to install the exhaust collar below.*

Thimble exhaust collar / exhaust transition is used when a Class II Type A2 biosafety cabinet is intended to be used for handling trace amount of chemical vapor that is potentially harmful to the user, if the vapor is exhausted into the lab. By using an exhaust system, chemical vapor is removed from the area above the exhaust ULPA filter to outside environment.

The exhaust collar shall be used in conjunction with staggered exhaust damper. Below is the instruction to install the collar and staggered damper:

1. Remove the thumbscrews and lift the sliding damper (Figures 1 and 2):

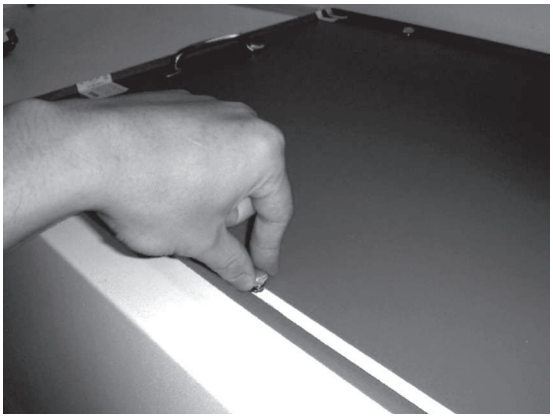


Fig. 1 *Remove the damper thumb screws*

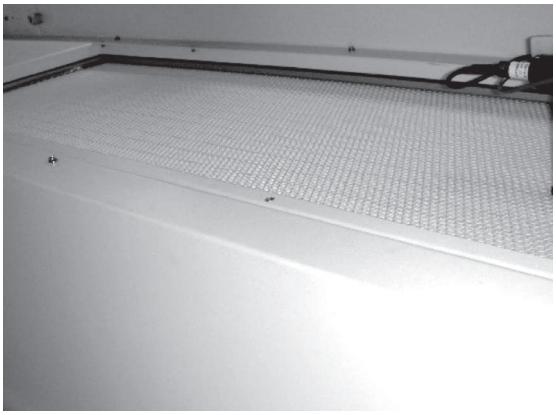


Fig. 2 *Sliding damper removed*

2. Install the staggered exhaust damper as follows (Figures 3 and 4):

Fig. 3 *Secure bottom part with thumb screw first, then put the top part*

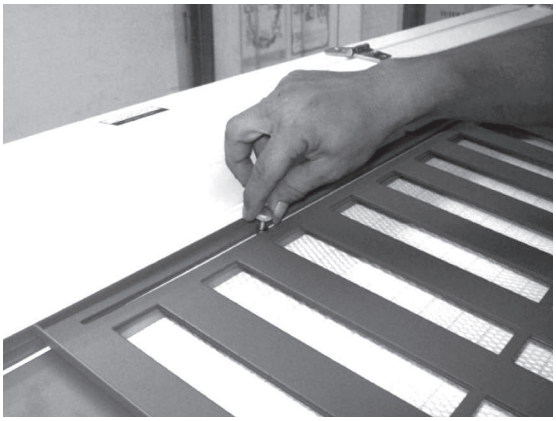


Fig. 4 *Secure the top part with thumb screw, that also passing through the slots on bottom part*

Note: *If the cabinet is already equipped with staggered damper, there is no need to change it, so please proceed to next section about exhaust collar installation. The procedure above only applies if the cabinet is equipped with sliding damper.*

3. Please ensure that the space around airflow sensor box is covered by the damper (Figures 5 and 6):

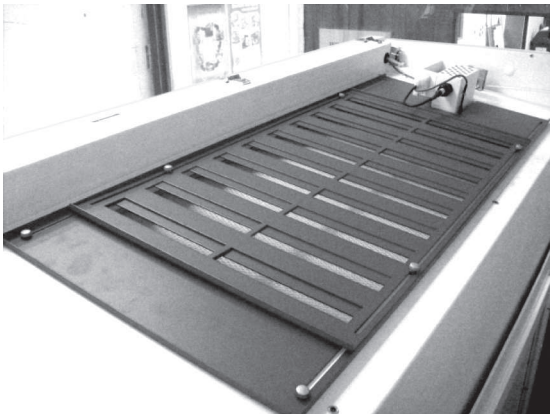


Fig. 5 *Overall view of damper, covering entire top area*

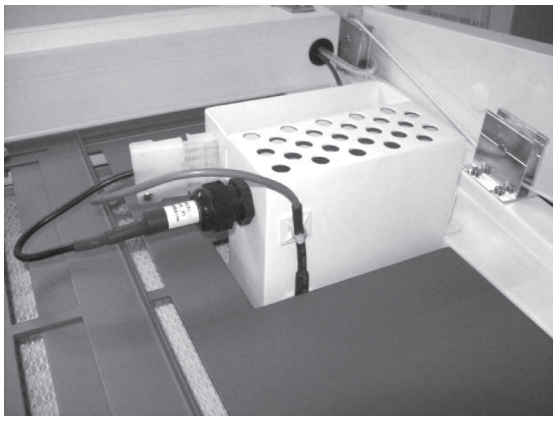


Fig. 6 *The larger cutout gives room for the temperature sensor cable*

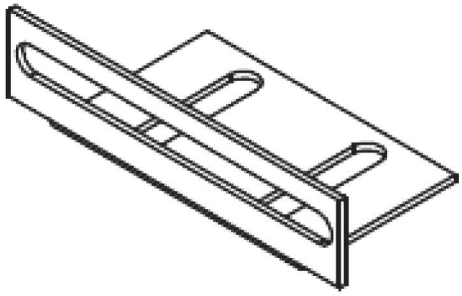


Fig. 7 *If the sensor box hits the damper, replace the sensor box L-bracket with this slotted L-bracket, that enables adjustment of sensor box position*

4. Balance the cabinet inflow and downflow, by adjusting the damper opening. Do this before installing the exhaust collar, so it's easier to adjust the damper opening. Measure and record the damper opening length. Maximum possible opening length is 1.5" (38 mm), when the slots from top and bottom plates align together.
5. Install the exhaust collar (Figures 8, 9, and 10):

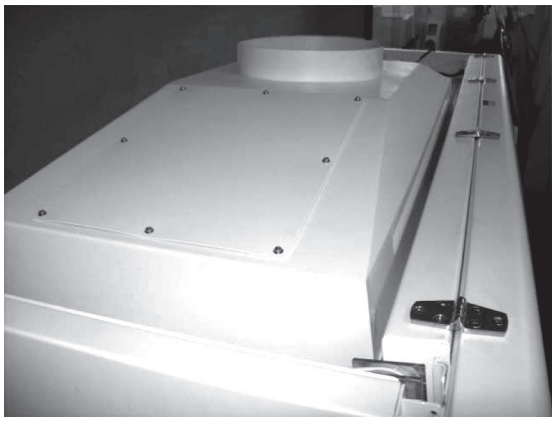


Fig. 8 *Exhaust collar, with slots only in front and back*

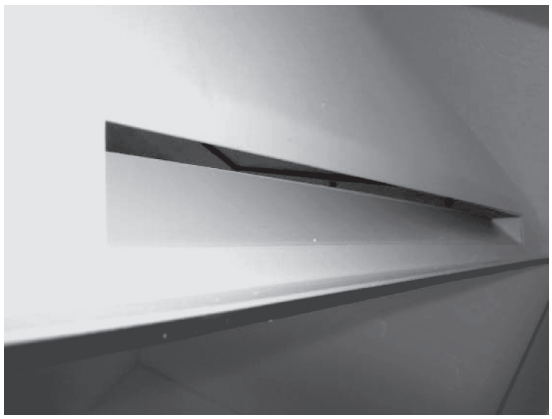


Fig. 9 *The collar must have 45° Air guide*

Fig. 10 *The airflow sensor cable should go through the cable slot on the exhaust collar*

6. Connect the exhaust collar with the exhaust duct, then turn on the cabinet fan and the exhaust fan.
7. Adjust the exhaust fan suction to be strong enough so that the smoke from the smoke tube can rapidly goes into the slots throughout their length, especially on the slot portion near the airflow sensor box (Figure 11)

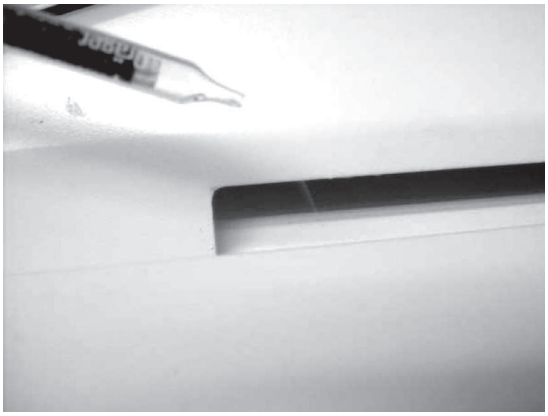


Fig. 11 *Smoke should be drawn rapidly into the slots, especially on the area near the airflow sensor box*

8. Measure the airflow coming into the exhaust collar inlets using thermo-anemometer, placed with vertical orientation pointing down (Figure 12), with the center of the sensor placed using the following grid:

Distance from outer points to walls	10 cm (4 inches)
Distance between one point to another	≤ 10 cm (4 inches)

Fig. 12 *Thermo-anemometer is placed vertically, with the center of the white tip at the center of the slot height. Mark the grid using pen and masking tape directly on the exhaust collar*

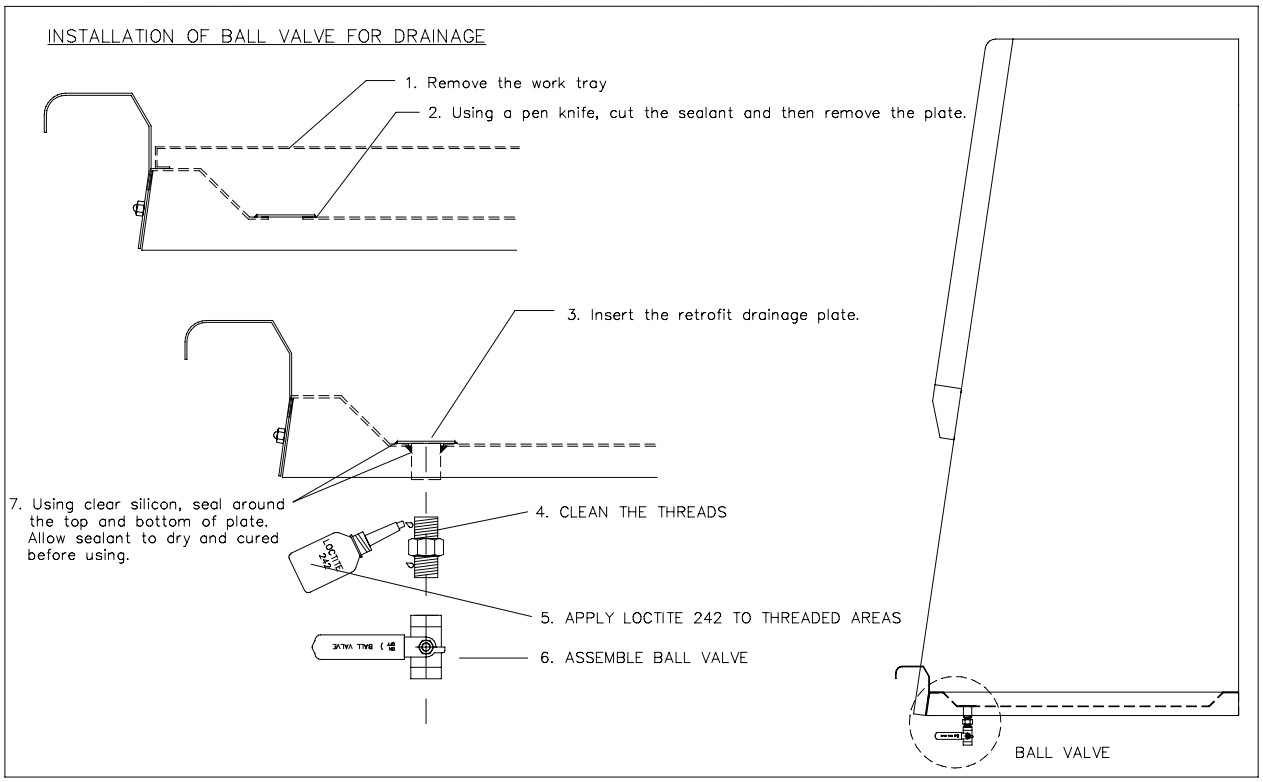
The approximate minimum collar slot air velocity and external fan negative pressure required for some cabinets:

No	Cabinet	Front Slot	Back Slot	Pressure required
1	LA2-3	0.67 m/s (132 fpm)	0.56 m/s (110 fpm)	5 Pa (0.02 "WG)
2	LA2-4	1.34 m/s (264 fpm)	1.37 m/s (270 fpm)	23 Pa (0.09 "WG)
3	LA2-6	1.39 m/s (274 fpm)	1.58 m/s (311 fpm)	40 Pa (0.16 "WG)

Note that the values above are minimum required inflow velocity. Having slightly greater velocity than the table above will increase containment, but if the velocity is too high, the downflow velocity may be weakened.

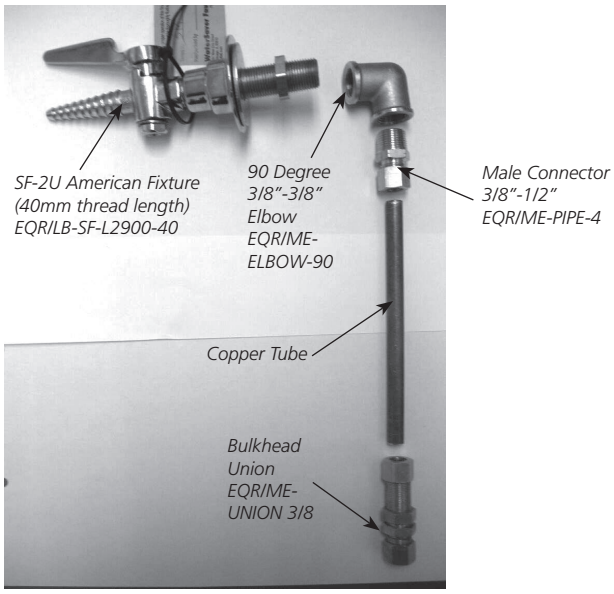
9. Re-calibrate the airflow sensor. Because the airflow velocity through the sensor box is different after the staggered damper and exhaust collar were installed, the airflow sensor requires re-calibration.

2.3 DRAIN VALVE INSTALLATION

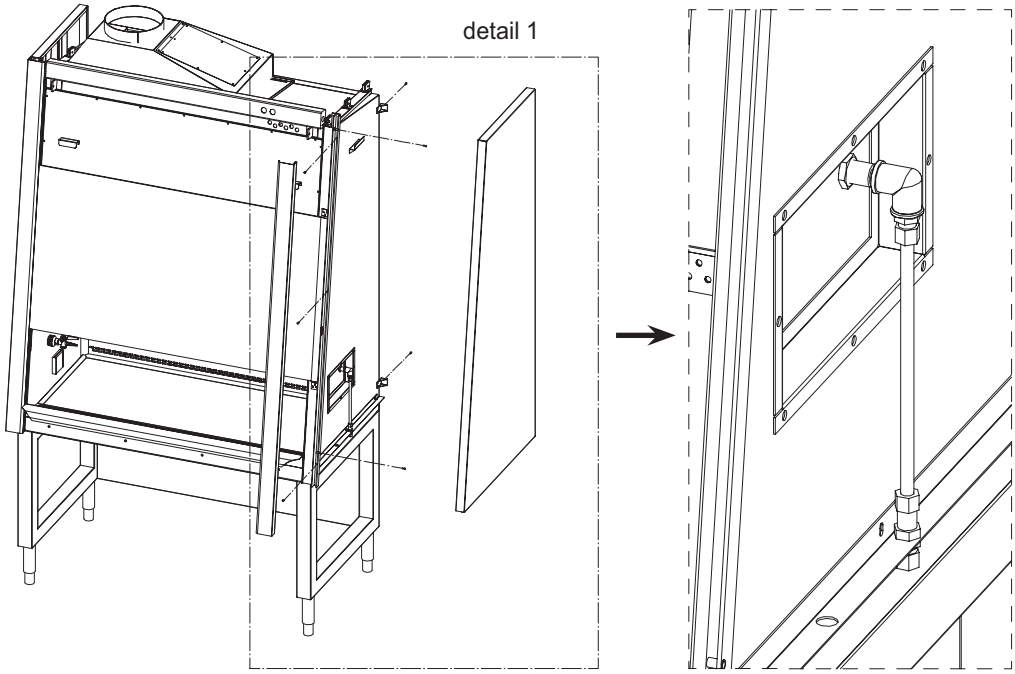

INSTALLATION OF BALL VALVE FOR DRAINAGE
1. Remove the work tray
2. Using a pen knife, cut the sealant and then remove the plate.
3. Insert the retrofit drainage plate.
7. Using clear silicon, seal around the top and bottom of plate. Allow sealant to dry and cured before using.
4. CLEAN THE THREADS
5. APPLY LOCTITE 242 TO THREADED AREAS
6. ASSEMBLE BALL VALVE
BALL VALVE

2.4 CABINET PLUMBING

1. All LA2 cabinets sent to North America/Taiwan (LA2-_A2) have pre-installed plumbing. Customers are only required to connect their ½" Copper Tube to the connectors at the bottom side of the cabinet. The components of the plumbs are as followed:



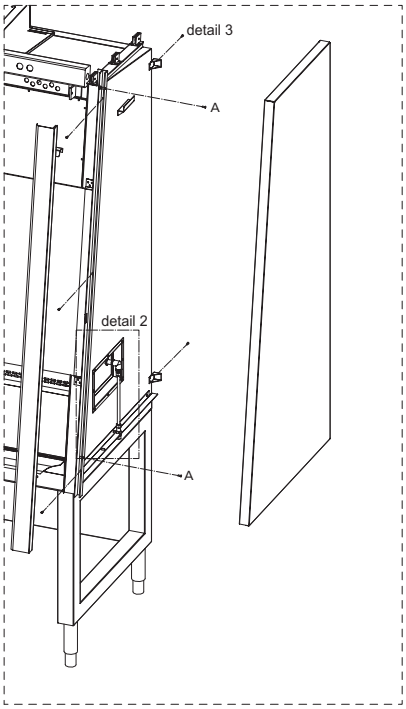
2. The way that the pipes installed onto the cabinets are as followed:



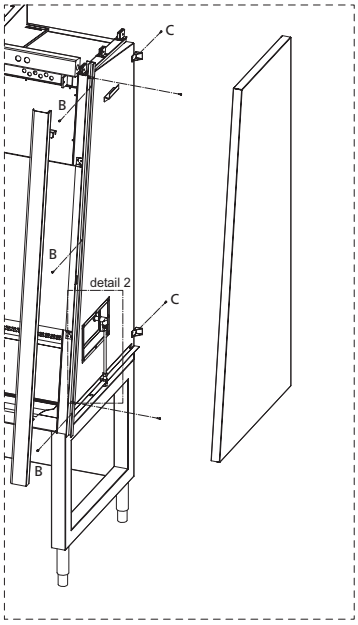
3. In order to replace, repair, or install a plumbing system, following steps need to be followed:

a. Open the front panel and keep it at fully open position

b. Open the front profile cover on the side where the plumbing is, by loosening the countersunk screws (A) from the side of the cabinet.

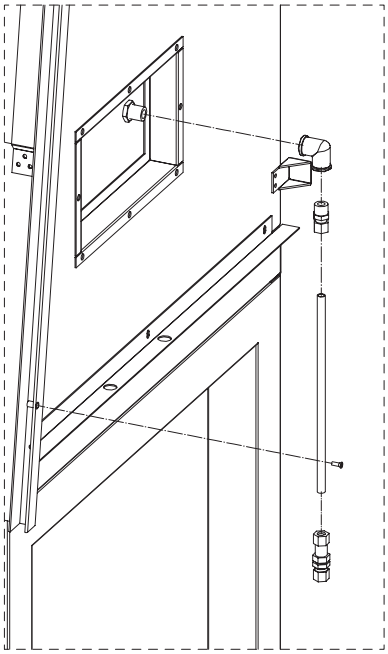


c. Unscrew 3 countersunk screws that connect the profile base to the side dress panel (B) and screws that connect the module to the dress panel at the back (C)



d. Lift the dress panel slightly up (around 15 mm), then pull the dress panel out to make the fixtures provision exposed.

e. Replace/ Repair/ Install the plumbing while it is open. Ensure connection is tight and loctite/seal tape is being used to prevent leakage. Test the connections based on Esco pre-installed piping standard of 80 psi, and check whether there is leakage or not.



f. Place back the side dress panel and reverse steps a to d to complete the installation.

2.5 CONNECTING THE CABINET

2.5.1 Connecting the Drain Valve

Connect the drain valve using the supplied PTFE tape and ensure it is turned to the off position.

2.5.2 Connecting the Electrical Supply

Connect the supplied electrical cord to the input on the top of the cabinet. Make sure the cable connector is seated firmly in the socket.

2.5.3 Connecting the Service Fixture(s)

If you have purchased service fixtures for your cabinet these will either have been factory installed or provided in a package located inside the work tray when you unpacked the cabinet.

If the fixtures have been provided for site installation there will be full instructions provided with them. Please refer to the instructions provided to install your retrofit kits.

Connecting the cabinet to service lines must be performed by a suitably qualified and certified engineer, in accordance with all applicable local, state and government regulations.

Where applicable, each connection should be tested and certified by the installation engineer.

Connections to service lines may be subject to the provision of pressure regulators and should always have an emergency shut off valve installed within easy reach of the cabinet operator.

2.5.4 Connecting to an Exhaust System

If you intend connecting the cabinet to an external exhaust system you will need an optional thimble (non air-tight) exhaust collar.

Full installation instructions are provided with the exhaust collar. Please refer to the instructions provided with the collar.

2.5.5 Safety and Warning Labels

The two biohazard decals included with this manual should be fixed to the door leading to your biohazard laboratory.

2.5.6 Preliminary Cleaning

Wipe the interior and exterior of the cabinet with water or a mild household detergent.

2.6 PERFORMANCE VALIDATION / CERTIFICATION

After having installed the cabinet but before starting to use it, cabinet performance must be validated and certified to factory standards. It is recommended that this validation and certification be performed only by a qualified technician who is familiar with the methods and procedures for certifying biological safety cabinets.

The testing methods and equipment needed for carrying out the tests are specified on the test report accompanying your cabinet.

Esco recommends that these tests be performed by a suitably qualified technician, familiar with both the methods and procedures for certification and your Esco product. Please refer to escoglobal.com to locate a local Esco Certified Partner.

2.6.1 Disclaimer

The performance and safety of all Esco cabinets are rigorously evaluated at our factory. Regular field certification is important to ensure factory standards are maintained.

REFERENCES FOR QUALIFIED CERTIFIERS

North America

- NSF (http://www.nsf.org/Certified/Biosafety-Certifier/)
- Esco (www.us.escoglobal.com)
- IAFCA-member certifying company (www.iafca.com/listview)

UK, China , India, Middle East/North Africa, Malaysia, Singapore

- Esco offers field certification services directly. Contact the local Esco office.

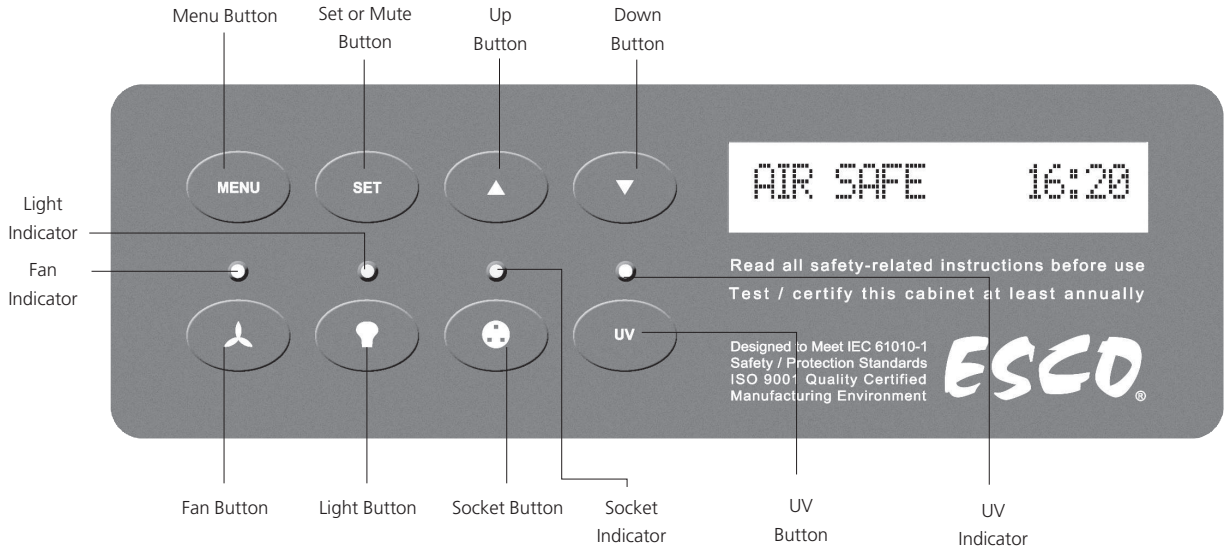
Other Countries

- Contact Esco or local distributor

CHAPTER 3
OPERATING YOUR CABINET

Proper operating practices are essential to achieve effective performance and protection. A properly functioning, certified cabinet alone is not sufficient. This chapter provides information on operating procedures and recommended work practices to help users achieve the best performance and protection.

3.1 SENTINEL™ CONTROL SYSTEM OVERVIEW



1. Fan Button

- Turns on and off the fan.

2. Light Button

- Turns on and off the light.
- Light goes on automatically when sash is at the operating position, READY state.
- Light goes off automatically when sash is at SASH ALARM state.

3. Socket Button

- Turns on and off the electrical socket (retrofit kit).
- Electrical outlet can be controlled fully in any sash position. The maximum rating of all the outlets in the cabinet is 5A. In case of overloading, the fuse F4 on relay board will trip. Contact Esco for replacement fuse.

Fig. 13a *Screen confirms electrical outlet is on*

Fig. 13b *Screen confirms electrical outlet is off*

4. UV Button

- Turns on and off the UV lamp (optional retrofit kit).
- UV lamp can only be activated when the sash window is fully closed. Since the sash is capable of filtering UV rays, users are protected from the harmful UV rays.

Avoid UV exposure to eyes and skin. Ensure the sash is fully closed before UV lamp is switched ON. Hazardous UV-C can be present internally. UV interlock should not be defeated at all times.

5. Up and Down Button

5.1 For LA2 Cabinets with Standard (Non-motorized) Window

Up and Down Button is used :

- To move upwards and downwards the menu options.
- To increase and decrease corresponding value inside one of the menu options.
- To start, stop and reset timer.
- Handheld stop clock is not allowed to be brought into the working space, as it might be a source of contamination. For this purpose, TIMER is provided and functions as a stop clock only in READY state. It is displayed in HH:MM:SS format. Airflow velocity is monitored during timer mode.
- User can start by pressing UP arrow button and it will start counting. Pressing UP button again will stop the timer. User can then press UP button again to resume the timer. During this time, pressing DOWN button will take the user out of the timer mode, and "Timer Reset" message is displayed.

Fig. 14a *Screen display when timer is running*

Fig. 14b *Screen display after timer is reset*

5.2 For LA2 Cabinets with Motorized Window

Up and Down Button is used :

- To control (move up and down) the window.
- To move upwards and downwards the menu options.
- To increase and decrease corresponding value inside one of the menu options.

6. Set or Mute Button

- To choose the menu or sub-menu currently displayed on the LCD screen.
- To proceed to the next step or sequence inside one of the menu options.
- To mute the alarm sound (only in fully open state during normal mode).

7. Menu Button

- To enter and exit from the menu options.
- To go back to the previous level of the menu options.

- To access maintenance mode from ERR.MSWITCH and AIRFAIL! error condition.

Some of the menu options allow the user to customize the cabinet for better working experience. *Please kindly refer to Section 3.7 for detailed explanations of each menu options.*

Alarm is disabled when you enter menu options

Before operating the cabinet, please ensure that you have set the Admin PIN (0009 by default) and Fan PIN (0001 by default).

The Admin PIN has higher priority and can be used to control the fan (override the Fan PIN) too.

Please contact Esco should you forget your ADMIN PIN.

3.2 CONCEPT OF DIFFERENT SASH WINDOW STATES

1. The sash window should be fully closed when the cabinet is not in use. This helps keep the work zone interior clean. The sash window also provides a protective barrier in case the UV lamp is used.
2. The sash window should always be in the normal operating height at all times when the cabinet is in use. Even if the cabinet is left unattended, but the blower is on, the sash window should never be moved from the normal operating height, unless during loading or unloading of materials / apparatus into the cabinet.
3. The alarm will be activated whenever the sash window is moved from the normal operating height.
4. Whenever the sash window is moved to the correct height from a higher or lower position, the light will automatically be turned on as a signal to the user.
5. The sash window may be opened to its maximum position for the purpose of loading / unloading of materials / apparatus into the cabinet. When the sash window is fully opened, the alarm sound may be muted by pressing MUTE Button but, will be automatically sounded again after 5 minutes to remind the user that it is not safe to work in the cabinet and the light will be turned on to facilitate cleaning.

3.3 STARTING THE CABINET

3.3.1 Wash hands thoroughly using germicidal soap. Wear gloves for hand protection. Gloves should be pulled over the knitted wrists of the gown instead of wearing them inside. Double gloving may be necessary for higher risk work.

3.3.2 Put on a clean laboratory coat with long-sleeves. A solid front-back closing lab gown provides better protection to personal clothing than a traditional lab coat. If a higher degree of risk is involved then you should consider using a disposable gown.

3.3.3 Adjust the seating position for optimal operator comfort. It is recommended to use a height adjustable stool. Refer to Section 3.5 on ergonomics for further information.

3.3.4 Fully open the sash window. Thoroughly surface-decontaminate the work surface, side walls, back wall, drain pan and internal surface of the window using 70% ethanol (or some other disinfectant depending on materials used in the cabinet). Surface-decontaminate the UV lamp and electrical outlets as well. Do not use any disinfectant containing chlorine-based substances as this may cause corrosion to the stainless steel surfaces.

3.3.5 Surface-decontaminate all apparatus / items before loading them into the work zone. While loading the materials or apparatus in the cabinet, they should be arranged in such a way that the movement of contaminated items over the clean ones is minimized. This can be achieved by placing the clean items on say the left side of the cabinet and the contaminated ones on the right side. Segregating the clean items from the contaminated ones in this way provides very good protection from cross-contamination.

3.3.6 Place all the apparatus / items on the safe working area as indicated on Section 3.4.3 of User Section below.

3.3.7 After all the apparatus / items have been arranged, adjust the sash to its normal operating height and allow the blower to run for another 3 minutes in order to purge work zone of contaminants that entered the work zone when the blower was off.

3.3.8 Minimize room activity (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the cabinet's internal airflow, thereby possibly impairing the containment capabilities of the cabinet.

3.4 WORKING IN THE CABINET

3.4.1 Ensure that the sash is at normal operating height (READY state) before starting any experiment. If the alarm indicator light blinks and the alarm sound at the same time, discontinue work immediately and properly shutdown the cabinet (Refer to Section 3.6 for details on shutdown procedure). Thereafter you may refer to the troubleshooting section of this manual (Service Section, Chapter 2).

3.4.2 Make sure that the front and back air grilles are not being obstructed by your arms or any other objects.

3.4.3 The safe working area of the cabinet is the center flat portion of the tray that has no perforations.

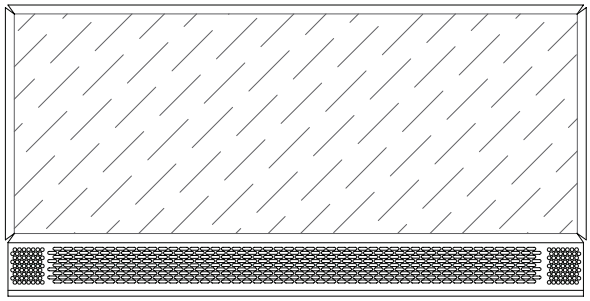


Fig. 15 *Safe work area on LA2-A & LA2-L Single Piece Work surface*

3.4.4 As far as possible, start working from the side of the cabinet where clean items/apparatus have been arranged and then move towards the sides where the contaminated/hazardous ones have been arranged. Such a practice would complement the technique of segregation of clean and dirty items/apparatus inside the cabinet that has been discussed in Section 3.3.5 in your endeavor to contain cross-contamination. Work with one specimen at a time and recap each specimen before moving to the next one.

3.4.5 Work as far inside the cabinet as possible - at least 150mm (6 inches) behind the front air intake grille. Hold open tubes and bottles as vertically as possible to avoid spillage. Discard empty tubes and bottles into collection bags placed inside the cabinet immediately after use.

3.4.6 Use convenient pipetting aids. Do not mouth-pipette. Use horizontal pipette discard pans containing some suitable disinfectant inside the biohazard safety cabinet. Do not use vertical pipette discard canisters on the floor outside the cabinet. Biohazard collection bags should be placed inside the cabinet.

3.4.7 If streaking loops are to be sterilized to prevent cross-contamination of biological materials, an electrical incinerator is recommended. The use of bunsen burner inside the work zone is not recommended.

Use of Bunsen burners within Esco biosafety cabinets is entirely at your own risk and Esco accepts no responsibility or liability for their use. Bunsen burner flames can disrupt the laminar airflow and will contribute to heat build up within the cabinet. However, if the use of a Bunsen burner is approved by a safety officer, it should be operated on the right side of the work zone. In Esco cabinets, the airflow sensor, when installed in the work zone, is mounted on the left side. Therefore operating the burner on the right side would not affect the cabinet airflow monitoring system.

All gas installations must be carried out in accordance with current national, state and local safety regulations by an authorized and approved installation engineer.

3.4.8 Surface-decontaminate before removing any potentially contaminated items from inside the cabinet.

3.4.9 Work in the cabinet in a slow and controlled manner. While putting items inside / removing items from the work zone, move your hands in and out of the work zone opening slowly and in a direction perpendicular to the plane of the work zone opening. Rapid movement of arms in a sweeping motion may disrupt the air barrier, thereby allowing contaminants to escape out of the cabinet. Make sure that you surface decontaminate before removing arms from the cabinet.

3.4.10 A disinfectant detergent is very well-suited for the cabinet because of its detergent-like properties. This is important because extraneous organic substances often interfere with the reaction between microorganisms and the active agent of the decontaminant.

3.4.11 Flood the top work surface tray and the drain pan below the work surface with a disinfectant and wait for 10 to 15 minutes. Remove excess disinfectant from the tray and drain pan by wiping with a sponge or cloth soaked in some decontaminant.

3.4.12 Drain the disinfectant from the base of the cabinet into some suitable container and autoclave. After the spillage has been cleaned, discard your outer gloves and start using a new pair. Allow the cabinet to purge contaminants that might have been left behind in the work zone for several minutes. Autoclave all contaminated accessories (including gloves, cloth, and sponge). Decontamination (using formaldehyde) may be necessary if a spillage has possibly contaminated the inaccessible surfaces of the cabinet.

3.4.13 Place aerosol-generating instruments (if any) as far inside the cabinet as possible.

3.4.14 Clean items / materials should be at least 150 mm away from aerosol generating instruments / objects to minimize the chances for cross contamination.

3.4.15 Hold lids / covers over dishes / sample plates in order to prevent the downward air from impinging on the samples.

3.4.16 Place air turbulence generating equipment (if any) such as centrifuges, blenders or sonicators towards the back of the cabinet. Stop other work while any of this equipment (if used) is in operation.

3.4.17 If a vacuum line is present, protect the building vacuum system from biohazards by placing a cartridge filter between the vacuum trap and the source valve in the cabinet.

3.4.18 When the sash is fully closed, the blower should be turned off to prevent overheating.

NB: *FAN PIN or ADMIN PIN would be needed for this. This is a safety feature to prevent unauthorized personnel from shutting down the cabinet.*

In case of contaminated spillage, use absorbent pads or towels to cover the spill and then soak it with 10% bleach. Wait for 10 to 15 minutes before cleaning the spill and the area (and equipments) surrounding it using a suitable disinfectant. Generally a 1% solution of an iodophor decontaminant (Wescodyne or equivalent) is effective against most viruses, fungi, vegetative bacteria and non-encysted amoeba.

3.5 WORKING ERGONOMICS

On most occasions, you would most likely be operating the cabinet in sitting rather than standing posture. There are some obvious advantages of the sitting posture:

3.5.1 The physiological energy cost and fatigue involved in sitting are relatively less

3.5.2 Sitting posture provides the body with a stable support

However, sitting position has some drawbacks too:

- The working area available is fairly limited
- There is a potential risk of being constrained in the same posture for a long time
- Sitting posture is one of the most stressful postures for one's back

Therefore you should pay careful attention to the following guidelines in order to achieve comfortable and healthy working conditions:

3.5.2.1 Always ensure that your legs have enough legroom.

3.5.2.2 Keep the lower back comfortably supported by your chair. Adjust the chair or use a pillow behind your back whenever necessary.

3.5.2.3 You should place your feet flat on the floor or on a footrest. Don't dangle your feet and compress your thighs.

3.5.2.4 You should keep varying your sitting position throughout the day at regular intervals so that you are never in the same posture for too long.

3.5.2.5 Observe the following precautions with respect to your eyes:

- Give your eyes frequent breaks. Periodically look away from the work area and focus at a distant point.
- Keep your glasses clean.

3.5.2.6 Arrange the items/apparatus frequently used in your work in such a way that you can minimize the physical strain involved in handling them.

3.5.2.7 Exercise regularly

3.5.2.8 The cabinet's noise emission has been tested and found to be in compliance with EN 12469, ISO 4871 and NSF / ANSI 49 which is important to ensure health and comfort for the operator.

3.5.2.9 Ergonomics accessories available with Esco include:

- Armrest padding
- Lab chair
- Footrest

Please contact your local distributor or Esco for more information.

3.6 CLEANING AND SHUTTING DOWN THE CABINET

3.6.1 **As far as possible, it is recommended that the cabinet be operated continuously in order to achieve optimal containment and cleanliness. All Esco cabinet blower systems are rated and have been tested for continuous operation.**

NB: *Airflow studies have shown that once the fan has been switched off, air from the cabinet may escape due to the thermal currents from inside the cabinet. So if you choose to turn off the cabinet, you need to carefully adhere to the following guidelines so as NOT to compromise safety and containment during shutdown.*

3.6.2 Biohazard waste should be discarded into biohazard bags (including the outer gloves, provided double gloving was employed by the operator). Seal the biohazard bags and dispose them off properly. If necessary, biohazard waste should be autoclaved.

3.6.3 Surface-decontaminate all the items apparatus using 70% Isopropyl Alcohol (IPA) before removing them from the cabinet. 100% IPA is not recommended because it will evaporate too fast before having sufficient contact time. It is recommended that the fan be left ON during this period.

3.6.4 Thoroughly wipe the work surface, side walls, inner back wall and drain pan using water and some mild antibacterial detergent. **Any disinfectant containing chlorine-based substances** may corrode the steel used in the cabinet. So if such disinfectant is used, the residue must be immediately wiped off by using cloth and non-corroding disinfectant, such as 70% Isopropyl Alcohol (IPA). Periodically clean behind the sash window too. For this you will have to unscrew the sash window track by unfastening the bolts at both ends of the sash track. After that, lift the sash window.

3.6.5 Wipe off the detergent using water. Make sure that there are no traces of detergent left.

3.6.6 Wipe the work surface, side walls, back wall and drain pan again with 70% Isopropyl Alcohol (IPA) or any other disinfecting agents listed on the next page.

3.6.7 Leave the blower on for 3 minutes in order to purge airborne contamination from the work zone. (default post-purge cycle time is 0 minute; this setting can be changed though - refer to **Section 3.7.1.3**)

3.6.8 Set the UV timer to 60 minutes or as the lab protocol dictates to decontaminate the interior of the cabinet. UV timer is disabled by default. Please refer to Section 3.7.1.4 for information on setting the UV timer. It is not recommended to leave the UV lamp ON overnight as it may shorten the lamp's lifespan. The UV lamps used in Esco cabinets have a lifespan of 8000 hours. By and large, the UV lamp should be replaced once a year in order to maintain its effectiveness.

Eyes and skin should not be exposed to direct ultraviolet light. The cabinet door should be closed fully before activating the UV lamp.

Ultraviolet light should not be relied upon as the sole decontaminating agent.

Check the UV interlock regularly for correct operation.

The user of UV lamp in biological safety cabinets has been explicitly discouraged in all major international standards and recommendations.

3.6.9 Remove the laboratory coat and thoroughly wash your hands using germicidal soap.

Disinfecting Agents

- For stainless steel surfaces, all common disinfecting agents except chlorine-based ones are suitable.
- For powder coated surfaces, all common disinfecting agents are suitable. However, the cabinet has been specifically evaluated for use with the following:

- 1N hydrochloric acid
- 1N sodium hydroxide
- 1% quaternary ammonium compound
- 5% formaldehyde
- 5,000 ppm hypochlorite
- 2% iodophor
- 5% phenol
- 70% ethyl alcohol
- Depending on the contaminant involved at the time of operating the cabinet, there are various other types of disinfecting agents that may be used. Table below outlines the effectiveness of various disinfecting agents against the different types of contaminants.

Decontaminant	**Gluteral-dehyde**	**Peroxide/ Peracetic acid/ Acetic acid**	**Chlorine Dioxide**	**Chlorine**	**Iodophor**	**Alcohol**	**Phenolic**	**Quater-nary Ammo-nium Com-pounds**
Classification	Sterilant	Sterilant	Sterilant	High Level	Intermediate	Intermediate	Intermediate	Low Level
Parameters for use:								
Concentration	2%	1%	1:5:1/100-1000 ppm	0.01-5%	0.5-2.5%	70-85%	0.2-3%	0.1-2%
Contact time (min.)	10-600	10-720	10-600	10-30	10-30	10-30	10-30	10-30
Stability > 1 week (1)	+		+		+	+	+	+
Agents:								
Bacterial Endospores	+	+	+	+/-				
Naked Viruses	+	+	+	+	+/- (2)	+/- (2)	+/- (2)	
Mycobacterium	+	+	+	+	+	+	+	
Vegetative Bacteria	+	+	+	+	+	+	+	+
Enveloped Viruses	+	+	+	+	+	+	+	+
Characteristics:								
Inactivated by Organics		+		+	+	+	+/-	+
Residual	+	+	+	+/-	+		+	
Corrosive		+		+	+		+	
Flammable						+		
Skin Irritant	+	+	+	+	+		+	
Eye Irritant	+	+	+	+	+	+	+	
Respiratory Irritant	+	+	+	+	+	+	+/-	
Toxic	+	+	+	+	+	+	+	+
Use in BSCs:								
Routine Surface Decon				+/-	+	+		+
Biohazardous Spill		+/-	+	+/-	+		+	+/-

(1) Protected from light and air
(2) Results vary depending on the virus

In any of the following eventualities, the user should ensure that the cabinet has been properly decontaminated, keeping in mind the nature of the pathogens used:

- At the time of moving/relocating the cabinet
- At the time of changing the type of work being carried out in the cabinet
- Before accessing contaminated areas for servicing, for example - filter replacement

Note: Formaldehyde Decontamination

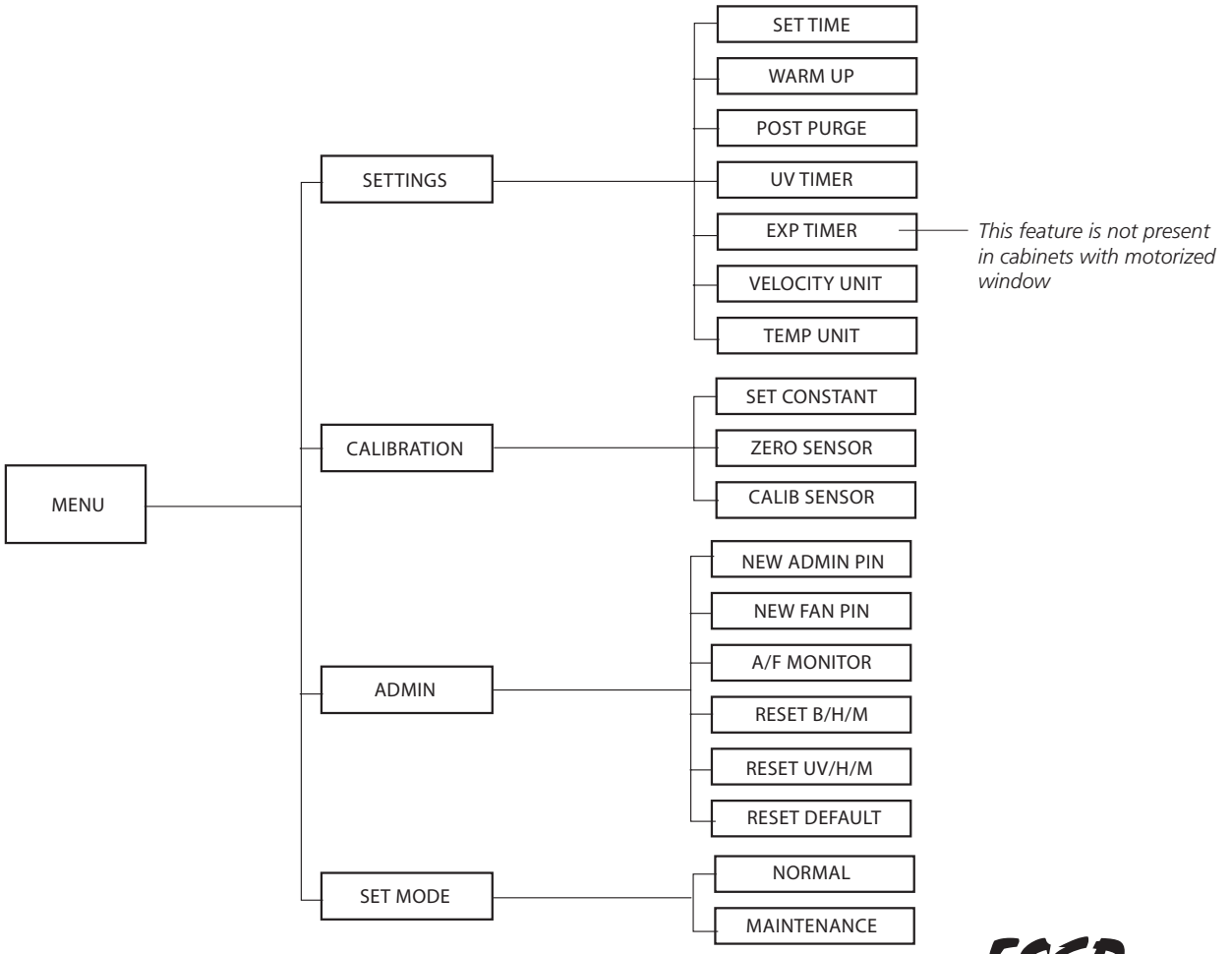
Decontamination may frequently be carried out by means of formaldehyde fumigation, typically only before filter / blower replacement.

For more information please refer to Chapter 1.11 of Service Section.

3.7 MENU OPTIONS

When you are entering menu options, the alarm will sound to indicate that the microprocessor is not monitoring the operation of the cabinet and as such will not give airflow alarms. No further warnings will be given. Therefore, it is highly recommended that the user set the ADMIN PIN, which will restrict unauthorized access to the menu. Please refer to Section 3.7.3.1 for further details. The default ADMIN PIN from the factory is 0009.

Please refer to the following diagram for complete reference to all menu options available. Press UP or DOWN button to move through the menu options. The user is strongly advised to exit from the menu options after making any changes in order to prevent unauthorized access to the menu.



3.7.1 Settings (Clock, Timer, and Units)

Press SET to enter the SETTINGS menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

3.7.1.1 Set Clock (Time)

Users can set the time by increasing/decreasing the hour and minute values. The correct time will be maintained even after the unit is turned off.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ **SET**	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select SET TIME from the menu and press SET to set the time.	⇕ **SET**	→ SET TIME WARM UP POST PURGE UV TIMER EXP TIMER VELOCITY UNIT TEMP UNIT
3	The Hour will flash, use the UP/DOWN buttons to select the correct hour and press SET to move on.	⇕ **SET**	Set 24 Hour Clock HH:MM Format: 00:00
4	The Minutes will flash, use the UP/DOWN buttons to select the correct minutes and press SET to move on.	⇕ **SET**	Set 24 Hour Clock HH:MM Format: 00:00
5	The display will show TIME SET for 2 seconds and then return to the SETTINGS menu.		Set 24 Hour Clock HH:MM Format: 00:00 TIME SET

3.7.1.2 Warm-Up Timer

There will be a period of warm-up, before the fan is fully functioning. This is to ensure that the sensors, the fan, and the control system are stabilized, as well as purging the work zone of contaminants. The default setting is 3 minutes and user can set it up to 15 minutes.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ **SET**	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select WARM UP from the menu and press SET to set the warm-up time.	⇕ **SET**	SET TIME → WARM UP POST PURGE UV TIMER EXP TIMER VELOCITY UNIT TEMP UNIT
3	The screen will show the number of minutes for the warm up timer. Use the UP/DOWN buttons to select the value you want.	⇕ **SET**	00 Minutes
4	Press SET to move on. The display will show WARM UP SET for 2 seconds and then return to the SETTINGS menu.	**SET**	00 Minutes WARM UP SET

3.7.1.3 Post Purge Timer

After the user switches off the fan, there will be a period of post-purge. This feature is to ensure that all residual contaminants are purged from the work zone. The default setting is zero minute and user can set it from zero minute to 15 minutes. Setting it to zero minute will disable this feature. However, it is recommended to purge the cabinet by leaving the fan on for around 3 minutes after the work is complete.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ **SET**	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select POST PURGE from the menu and press SET to set the post purge time.	⇕ **SET**	SET TIME WARM UP → POST PURGE UV TIMER EXP TIMER VELOCITY UNIT TEMP UNIT
3	The screen will show the number of minutes for the Post Purge timer. Use the UP/DOWN buttons to select the value you want.	⇕ **SET**	00 Minutes
4	Press SET to move on. The display will show POST PURGE SET for 2 seconds and then return to the SETTINGS menu	**SET**	00 Minutes POSTPURGE SET

3.7.1.4 UV Timer

To switch off the UV light automatically after a fixed period, UV TIMER can be used. The UV TIMER can be set up to 18 hours. By default, this feature is disabled. UV light, then, has to be switched off manually.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ **SET**	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select UV TIMER from the menu and press SET to set the UV timer.	⇕ **SET**	SET TIME WARM UP POST PURGE → UV TIMER EXP TIMER VELOCITY UNIT TEMP UNIT
3	The Hour will flash, use the UP/DOWN buttons to select the correct hour and press SET to move on.	⇕ **SET**	Set 24 Hour Clock HH:MM Format: 00:00
4	The Minutes will flash, use the UP/DOWN buttons to select the correct minutes and press SET to move on	⇕ **SET**	Set 24 Hour Clock HH:MM Format: 00:00
5	The display will show UV TIMER SET for 2 seconds and then return to the SETTINGS menu.		Set 24 Hour Clock HH:MM Format: 00:00 UV TIMER SET

3.7.1.5 EXP Timer

Note: *This feature is absent for cabinets with motorized window*

To monitor the timing for critical experiments, EXP TIMER can be used. It basically serves as a countdown timer. You can set the EXP TIMER to any time period between "00:00:00" and "17:59:59" (HH:MM:SS format).

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ SET	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select EXP TIMER from the menu and press SET to set the experiment timer.	⇕ SET	SET TIME WARM UP POST PURGE UV TIMER → EXP TIMER VELOCITY UNIT TEMP UNIT
3	The Hour will flash, use the UP/DOWN buttons to select the correct hour and press SET to move on.	⇕ SET	Set 24 Hour Clock HH:MM:SS Format: 00:00:00
4	The Minutes will flash, use the UP/DOWN buttons to select the correct minutes and press SET to move on.	⇕ SET	Set 24 Hour Clock HH:MM:SS Format: 00:00:00
5	The Seconds will flash, use the UP/DOWN buttons to select the correct seconds and press SET to move on.	⇕ SET	Set 24 Hour Clock HH:MM:SS Format: 00:00:00
6	The display will show EXP TIMER SET for 2 seconds and then return to the SETTINGS menu.		Set 24 Hour Clock HH:MM:SS Format:00:00:00 EXP TIMER SET

3.7.1.6 Air Velocity Unit Selection

Using this option, you can select the unit in which air velocity is measured and displayed. You can choose between meter per second (m/s) and feet per minute (fpm). When the fan is running and also during the calibration process, airflow measurement is displayed in the selected unit.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ SET	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select VELOCITY UNIT from the menu and press SET to select the display units for air velocity.	⇕ SET	SET TIME WARM UP POST PURGE UV TIMER EXP TIMER → VELOCITY UNIT TEMP UNIT
3	Using the UP/DOWN buttons, select from the available options and then press SET to record your choice and return to the SETTINGS menu.	⇕ SET	→ fpm m/s

3.7.1.7 Temperature Unit Selection

Using this option, you can select the unit in which temperature is measured and displayed. You can choose between Celsius and Fahrenheit. The exhaust temperature is displayed in the selected unit.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SETTINGS from the menu and press SET to enter the Settings Menu.	⇕ **SET**	→ SETTINGS CALIBRATION ADMIN SET MODE
2	Using the UP/DOWN buttons, select TEMP UNIT from the menu and press SET to select the display units for cabinet temperature.	⇕ **SET**	SET TIME WARM UP POST PURGE UV TIMER EXP TIMER VELOCITY UNIT → TEMP UNIT
3	Using the UP/DOWN buttons, select from the available options and then press SET to record your choice and return to the SETTINGS menu.	⇕ **SET**	→ Celsius Fahrenheit

3.7.2 Calibration

The calibration must be done in maintenance mode.

- Press SET to enter the CALIBRATION menu. Use the UP and DOWN button to move through the available options.
- Press MENU to go back to the previous level.

3.7.2.1 Set Constant

Every sensor manufactured by Esco has a specific Sensor Constant which is used for temperature compensation performed by the temperature sensor. For more information, please refer to Microprocessor Calibration Section of the Test Report.

3.7.2.2 Zero Sensor

This option is to let the controller record the specific sensor output voltage and correspond it to 0 m/s or 0 fpm. Please refer to Microprocessor Calibration Section of the Test Report for details on how to use this feature.

3.7.2.3 Calib Sensor

This option allows proper calibration and operation of the airflow sensor alarm. There will be three points to be calibrated, namely inflow fail point, inflow nominal point, and downflow nominal point. Details of this option can be found in Microprocessor Calibration Section of the Test Report.

- Calibration must be performed by qualified personnel.
- Calibration should be done when the airflow alarm accuracy is suspected and at least once a year.

3.7.3 Administrator Access and Pin

Press SET to enter the ADMIN menu. Use the UP and DOWN button to move through the available options. Press MENU to go back to the previous level.

3.7.3.1 New Admin PIN

ADMIN PIN restricts access to MENU functions, including service functions, like calibration. User must enter four digit PIN before accessing MENU. Admin PIN has higher priority and can be used to control the fan (override FanPIN).

ADMIN PIN can also be used to switch to Maintenance Mode from ERR.MSWITCH and AIRFAIL! Error condition. The default PIN is 0009. Setting PIN to 0000 will disable this feature. Please follow the following steps to set a new ADMIN PIN:

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ SET	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select NEW ADMIN PIN from the menu and press SET to set a new administrator password.	⇕ SET	→ NEW ADMIN PIN NEW FAN PIN A/F MONITOR RESET B/H/M RESET UV/H/M RESET DEFAULT
3	Using the UP/DOWN buttons, select the first digit of the PIN number and then press SET to move on.	⇕ SET	Admin Pin: XXXX Format: 1
4	Using the UP/DOWN buttons, select the second digit of the PIN number and then press SET to move on.	⇕ SET	Admin Pin: XXXX Format: 12
5	Using the UP/DOWN buttons, select the third digit of the PIN number and then press SET to move on.	⇕ SET	Admin Pin: XXXX Format: 123
6	Using the UP/DOWN buttons, select the last digit of the PIN number and then press SET to move on.	⇕ SET	Admin Pin: XXXX Format: 1234
7	The display will show CONFIRM PIN and then return to the ADMIN menu.		Admin Pin: XXXX Format: 1234 CONFIRM PIN

3.7.3.2 New Fan PIN

FAN PIN restricts access to fan control. User must enter four-digit PIN before switching fan on or off. As such, it can restrict access to operating the cabinet by unauthorized personnel. It will also prevent unauthorized shutdown of the cabinet when continuous operation is required. Note that continuous operation is recommended for better safety. FAN PIN is also needed to disable the alarm when the sash is fully raised and cleaning needs to be performed.

It is recommended that the FAN PIN be issued only to personnel authorized to use the cabinet.

The default PIN is 0001. Setting the PIN to 0000 will disable this feature. Please follow the following steps to set a new FAN PIN:

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ SET	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select NEW FAN PIN from the menu and press SET to set a new fan password.	⇕ SET	NEW ADMIN PIN → NEW FAN PIN A/F MONITOR RESET B/H/M RESET UV/H/M RESET DEFAULT
3	Using the UP/DOWN buttons, select the first digit of the PIN number and then press SET to move on.	⇕ SET	Fan Pin: XXXX Format: 1
4	Using the UP/DOWN buttons, select the second digit of the PIN number and then press SET to move on.	⇕ SET	Fan Pin: XXXX Format: 12
5	Using the UP/DOWN buttons, select the third digit of the PIN number and then press SET to move on.	⇕ SET	Fan Pin: XXXX Format: 123
6	Using the UP/DOWN buttons, select the last digit of the PIN number and then press SET to move on.	⇕ SET	Fan Pin: XXXX Format: 1234
7	The display will show CONFIRM PIN and then return to the ADMIN menu.		Fan Pin: XXXX Format: 1234 CONFIRM PIN

3.7.3.3 A/F Monitor

Whenever the air velocity falls below the fail point, the air fail alarm will be triggered. This option is used to enable/disable alarm.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ SET	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select A/F MONITOR from the menu and press SET to enable or disable the airflow monitor (activates/deactivates alarms).	⇕ SET	NEW ADMIN PIN NEW FAN PIN → A/F MONITOR RESET B/H/M RESET UV/H/M RESET DEFAULT
3	Using the UP/DOWN buttons, select your choice from the menu and press SET button to return to the ADMIN Menu.	⇕ SET	→ DISABLE ENABLE

3.7.3.4 Reset Blower Hour Meter

This option is used to reset the blower hour meter. The blower hour meter indicates how long the blower has been in operation. Maximum counter is set at 9999 hours. The counter value can be checked while in maintenance mode. The value can also provide some help in setting up maintenance schedule, including filter change.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ SET	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET B/H/M from the menu and press SET to reset the blower hour meter.	⇕ SET	NEW ADMIN PIN NEW FAN PIN A/F MONITOR → RESET B/H/M RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		Read Manual Press SET
4	Press the SET button to confirm that you want to reset the meter. If you do not want to reset the meter you can press MENU to exit to the previous screen.	**SET or MENU**	NEW ADMIN PIN NEW FAN PIN A/F MONITOR → RESET B/H/M RESET UV/H/M RESET DEFAULT

3.7.3.5 Reset UV Hour Meter

This option is used to reset the UV hour meter. The UV hour meter indicates how long the UV lamp has been used. Maximum counter is set at 9999 hours. The counter value can be checked while in maintenance mode. Please reset the UV hour meter after each UV replacement.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ SET	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET UV/H/M from the menu and press SET to reset the UV hour meter.	⇕ SET	NEW ADMIN PIN NEW FAN PIN A/F MONITOR RESET B/H/M → RESET UV/H/M RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		Read Manual Press SET
4	Press the SET button to confirm that you want to reset the meter. If you do not want to reset the meter you can press MENU to exit to the previous screen.	**SET or MENU**	NEW ADMIN PIN NEW FAN PIN A/F MONITOR RESET B/H/M → RESET UV/H/M RESET DEFAULT

3.7.3.6 Reset Default

User can reset the default setting by choosing this option. The features being reset are WARM-UP period (3 minutes), POST-PURGE period (0 minute), UV TIMER (0 minute), VELOCITY UNIT (m/s), TEMP UNIT (Celsius), ADMIN PIN (0009) and FAN PIN (0001).

Note that the calibration settings cannot be reset as it may cause the cabinet to operate in an unsafe manner. The hour meters cannot be reset either.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select ADMIN from the menu and press SET to enter the Admin Menu.	⇕ **SET**	SETTINGS CALIBRATION → ADMIN SET MODE
2	Using the UP/DOWN buttons, select RESET DEFAULT from the menu and press SET to reset values to their default values.	⇕ **SET**	NEW ADMIN PIN NEW FAN PIN A/F MONITOR RESET B/H/M RESET UV/H/M → RESET DEFAULT
3	The screen prompts you with a warning to make sure that you understand this process.		Read Manual Press SET
4	Press the SET button to confirm that you want to reset the values to their defaults. If you do not want to reset the values you can press MENU to exit to the previous screen.	**SET** **or** **MENU**	NEW ADMIN PIN NEW FAN PIN A/F MONITOR RESET B/H/M RESET UV/H/M → RESET DEFAULT

3.7.4 Setting the Mode

3.7.4.1 Normal Mode

This is the default operation mode. Every time the cabinet is restarted, this mode will be activated by default.

3.7.4.2 Maintenance Mode

The maintenance mode can be used for the following purposes:

1. Calibration/ Performance validation
2. Filter scanning
3. Decontamination
4. Checking of input/output diagnostics

Please refer to Microprocessor Calibration Section of the Test Report for more details.

This mode should only be used during maintenance by qualified personnel.

Step	Action	Press	Display Shows
1	Using the UP/DOWN buttons, select SET MODE from the menu and press SET to set the operating mode of the cabinet.	⇕ **SET**	SETTINGS CALIBRATION ADMIN ⟶ SET MODE
2	Using the UP/DOWN buttons, select your choice of operating mode from the menu and then press SET to confirm and return to the previous menu.	⇕ **SET**	⟶ Normal Maintenance

CHAPTER 4
MAINTAINING YOUR CABINET

Proper and timely maintenance is crucial for trouble free functioning of any device and your Esco cabinet is no exception to this rule. We strongly recommend that you follow the maintenance schedule suggested hereunder in order to obtain optimal performance from your Esco cabinet.

Description of Task to Perform	Maintenance to be carried out every					
	Day	Week	Month	Quarter	1 Year	2 Years
1. Surface decontaminate the work zone	✓					
2. Cabinet power-up alarm verification	✓					
3. Thoroughly surface decontaminate the drain pan		✓				
4. Check the paper catch for retained materials		✓				
5. Clean the exterior surfaces of the cabinet			✓			
6. Check all service fixtures (where present) for proper operation			✓			
7. Inspect the cabinet for any physical abnormalities or malfunction				✓		
8. Clean up stainless steel surfaces with MEK				✓		
9. Re-certification					✓	
10. Change UV Lamp (where present)					✓	
11. Change the fluorescent lamps						✓

1. **Surface decontaminate the work zone.**

   Thoroughly wipe the work surface, side walls, inner back walls and all other surfaces in the interior of the cabinet using a disinfectant appropriate for the work being conducted in your lab. If using a commercial preparation, it is helpful to follow up your wipe with a 70% ethanol rinse. Ethanol can help the disinfectant to evaporate cleanly.

   Do not use any disinfectant containing chlorine-based substances as it may corrode the steel used in the cabinet resulting in irreparable damage to the cabinet's structure. Surface decontamination should be carried out for the UV lights and electrical outlet as well. While cleaning the interior of the cabinet, make sure that no parts of your body except your hands go inside the cabinet. Please refer to the user section for details of appropriate disinfecting agents.

2. **Cabinet power-up alarm verification.**

   When the cabinet is powered up, the LCD screen will show PLS CHECK PANEL, all LEDS on the Sentinel control panel will be illuminated and the alarm will sound. This state should last 6 seconds while the system initializes.

   Upon correct initialization the alarms will silence, LEDS will assume normal state and the LCD screen will show the system status.

3. **Thoroughly surface-decontaminate the drain pan.**

   Thoroughly wipe the drain pan using a disinfectant appropriate for the work being conducted in your lab. If using a commercial preparation, it is helpful to follow up your wipe with a 70% ethanol rinse. Ethanol can help the disinfectant to evaporate cleanly.

   Do not use any disinfectant containing chlorine-based substances as it may corrode the steel used in the cabinet resulting in irreparable damage to the cabinet's structure. Please refer to the user section for details of appropriate disinfecting agents.

4. **Check the paper catch for retained materials.**

   Whilst the work tray is out of the cabinet, examine the paper catch at the base of the back wall for obstructions. Remove any retained materials.

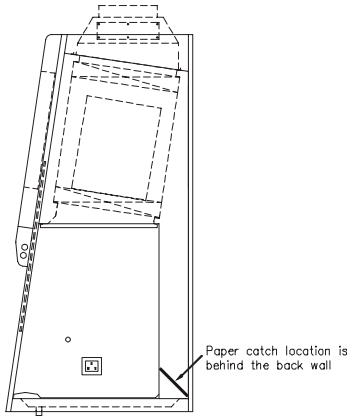


Fig. 16 *Side view - Paper catch location*

5. **Clean the exterior surfaces of the cabinet.**

   Using a damp cloth, clean the exterior surfaces of the cabinet, particularly the front and top of the cabinet in order to remove the dust accumulated there.

6. **Check all service fixtures (where present) for proper operation.**

   Observe local, state and national regulations as to when you need to get your service lines and fixtures certified.

7. **Inspect the cabinet for any physical abnormalities or malfunction.**

   Check both fluorescent tubes (and UV light if present) to ensure that they are functioning properly and replace the bulbs if necessary.

8. **Clean up Stainless Steel Surfaces with MEK**

   For removing stubborn stains or spots on the stainless steel surface, make use of MEK (Methyl-Ethyl-Ketone). In such cases, make sure that you wash the steel surface immediately afterwards with clean water and some liquid detergent. Use a polyurethane cloth or sponge for washing. Regularly cleaning the stainless steel surface can help you retain the attractive factory finish.

9. **Re-certification**

   All biological safety cabinets must be re-certified annually by a certified engineer. The engineer will test downflow and inflow velocities, airflow patterns, the filter and perform a cabinet leak test to ensure that the BSC is working properly.

10. **Change UV lamp (where present).**

    To remove the old lamp, turn the tube 90 degrees and slide it out from the bracket.

    To insert the new lamp, slide it in to the socket and when fully inserted, turn the bulb 90 degrees to lock into position. Surface decontamination should be performed after changing the UV bulb.

11. **Change the fluorescent lamps.**

    There are two or four fluorescent lamps in the cabinet; they are located behind the blue panel at the top of the sash.

    Before changing the fluorescent bulbs, ensure that the cabinet is powered down and disconnected from the electrical supply.

    Raise the front cover and locate the bulbs.

    Remove the power clips at the ends of the bulbs by gently pulling whilst holding the bulb steady.

    Remove the bulbs from the mounting clips and replace with new ones.

    Replace the power clips at the ends of the new bulbs and ensure they are firmly seated.

    Close the panel, reconnect the cabinet to the electrical supply and test the bulbs for proper operation.

LOG RECORD

It is good practice (and in some cases regulatory requirement) to maintain a log of all maintenance work carried out on your cabinet. Esco has an example Maintenance Log available for download from the resources section of our website, www.escoglobal.com.

SERVICE SECTION

CHAPTER 1
RE-CERTIFICATION AND MAINTENANCE BY SERVICE PERSONNEL

Esco products generally provide years of trouble-free operation however like all equipment they require maintenance and service.

Maintenance and service should be carried out by trained personnel. Esco offers training courses to equip service providers with the latest skills, information and tools to successfully maintain and service Esco products. For more information on the nearest training course, please contact Esco.

Service providers should familiarize themselves with the basic operating principles of products before working on them. Suitable references include information in the User Section of this Manual or brochures which may be downloaded from the Esco website.

Biological safety cabinets generally require:

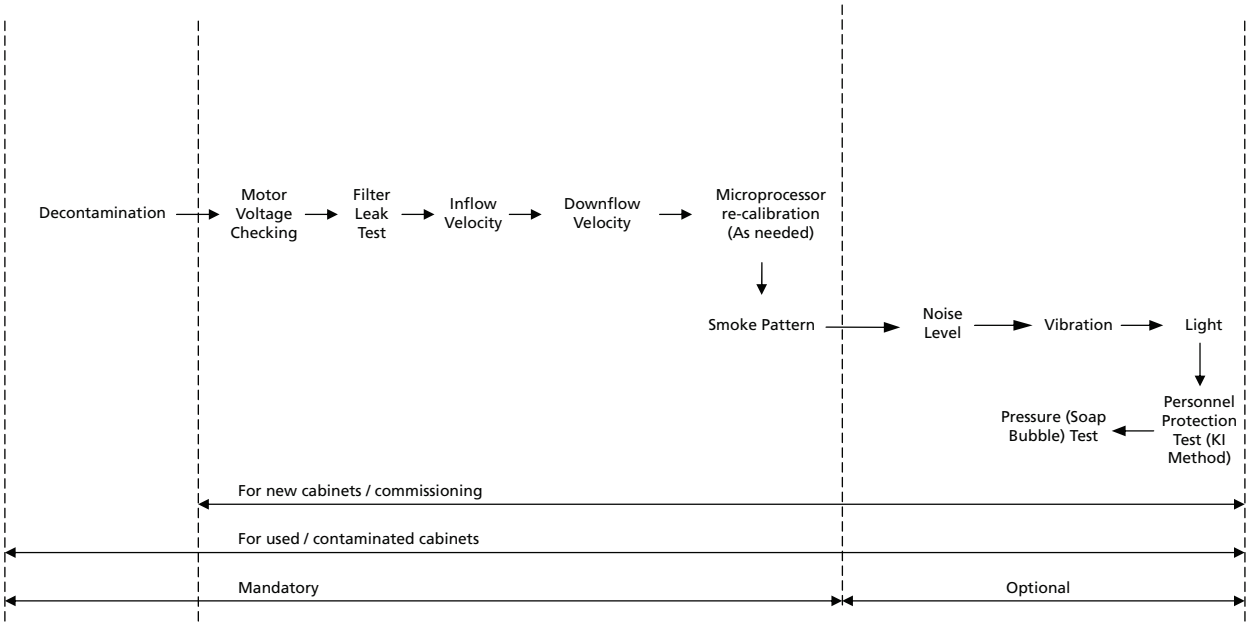
- Re-certification, when:
    a. The cabinet is re-located
    b. Cabinet performance is suspected
    c. After filter or blower replacement
    d. At least once a year

During recertification:

    a. Cabinet airflow velocities and flow patterns are verified against the manufacturer's specifications and relevant international standards
    b. Filters are scan-tested to ensure they do not leak
    c. Operator comfort tests may be performed
    d. If airflow velocities are found to be off setpoint, adjustments are made as part of the certification process before final values are recorded.

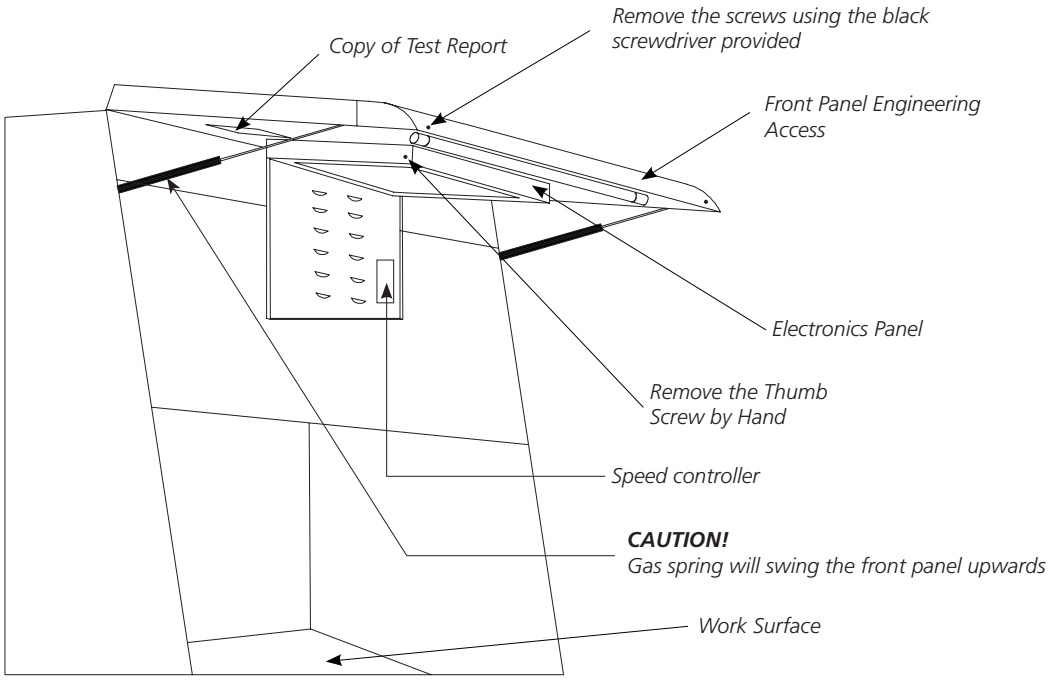
- Airflow alarm calibration, when:
    a. The cause of the airflow alarm cannot be determined
    b. Re-certification indicates the displayed airflow deviates by >0.02m/s (4fpm) from actual measured velocities.(Only for products with airflow velocity displays)
- Decontamination before filter or fan replacement, or as specified.
- Filter replacement, when:
    a. The filters are clogged and the fan(s) are already adjusted to maximum setting
    b. Filter leaks which cannot be repaired are found during scan-testing (Before filter replacement, the cabinet must be decontaminated).
- Fan replacement (typically rare) if failure occurs.
- Routine maintenance also includes:
    a. Fluorescent lamp(s) replacement - typically once every 2 years.
    b. UV lamp replacement - typically once every 1 year.

1.1 CERTIFICATION FLOWCHART



Note: *Motor Voltage Checking is only done for new cabinets / commissioning*

1.2 AIRFLOW ADJUSTMENT


Copy of Test Report
Remove the screws using the black screwdriver provided
Front Panel Engineering Access
Electronics Panel
Remove the Thumb Screw by Hand
Speed controller
CAUTION!
Gas spring will swing the front panel upwards
Work Surface

The speed controller is located in the electronics panel which is accessed by raising the front engineering access panel at the top of the front of the cabinet and then opening the drop-down cover by removing the two screws on the front left and right sides of the cover.

Plug the multimeter probes to the Motor Voltage Sampling Port. Use the multimeter to take the voltage air velocity reading.

Adjust the airflow by adjusting the speed controller. The speed controller is different for 230V and 115V cabinets. For 230V cabinet, use a yellow screwdriver provided to adjust the speed controller. For 115V cabinets, use the knob provided to adjust the speed controller.

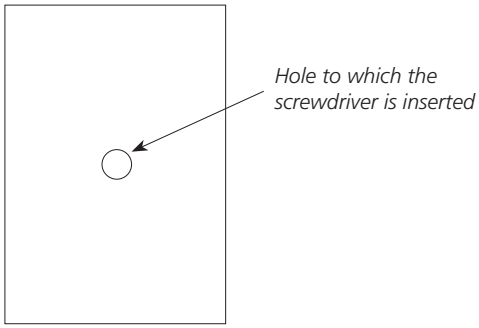


Fig. 17 *Speed controller of 230V cabinets*
Adjust the speed controller using a screwdriver

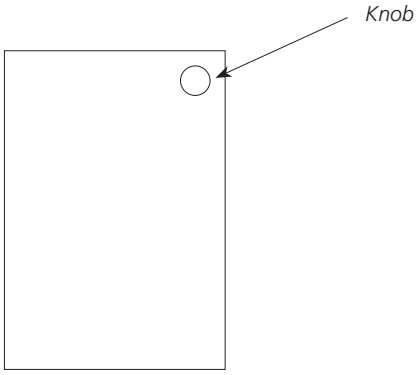
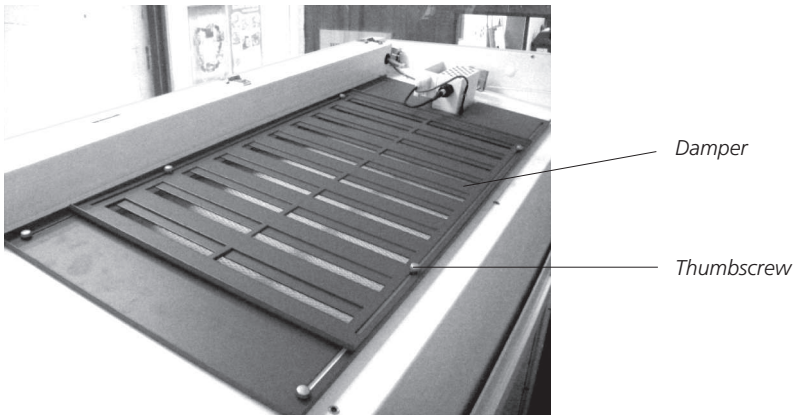


Fig.18 *Speed controller of 115V cabinets.*
Adjust the speed controller by turning on the knob.

1.3 DAMPER ADJUSTMENT

The damper is used to balance the downflow velocity and exhaust velocity.The damper needs to be adjusted when the downflow velocity does not meet the accepted criteria (3,4,5' unit:0.35 m/s and 6' unit : 0.33 m/s). Open the damper opening if the downflow velocity is too high, close the damper opening if the downflow velocity is too low.

Loosen the thumbscrew(s) to slide the damper left or right to increase or reduce the downflow velocity.



1.4 UNIT RE-CERTIFICATION

Steps to perform certification:

1. Perform the HEPA Filter PAO Leak Test

Acceptance criteria / testing procedures have been adopted in accordance with the requirements of the:

- NSF/ANSI 49-2002 Standard (Section 6.3 and Annex A Section 2)
- European Standard EN12469:2000 (Sections 7.3 and 7.5 / Annex D)
- IEST-RP-CC034.1:2001 "Recommended Practice for HEPA and ULPA Filter Leak Tests".

Challenge the downflow (supply) and exhaust filters with PAO aerosol of fixed concentration.

Distribute the aerosol evenly throughout the supply (positive) cabinet plenum.

Using aerosol photometer, monitor aerosol penetration downstream of both filters, and scan for the presence of leaks.

Use the following table to assess the filter performance:

PAO CONCENTRATION		**_____µg/liter**		**NSF 49:2000 requires > 10 µg/liter, but > 25 µg/liter is recommended.**
DOWNFLOW FILTER		EXHAUST FILTER		Upstream concentration calculative method
Leaks detected in media	Yes / No	Leaks detected in media	Yes / No	
Leaks detected in gasket	Yes / No	Leaks detected in gasket	Yes / No	13,500 x N / Total Airflow Cfm
Particle penetration	_____%	Particle penetration	_____%	

Notes:

- *Always check background aerosol concentration in room. Make sure it's not too high*
- *Check the upstream aerosol concentration again after the test is completed to ensure same value*
- *When switching between upstream / clear / downstream, let photometer purge for a minute*
- *For field testing: to avoid accessing contaminated sampling tube, use calculative method above*
- *The approximate total airflow is shown in table below (N = number of Laskin nozzle opened):*

Cabinet	**LA2-3A_ LA2-3A_-M**	**LA2-4A_ LA2-4A_-M**	**LA2-5A_ LA2-5A_-M**	**LA2-6A_ LA2-6A_-M**
Total Airflow (cfm)	660	873	1079	1285

Cabinet	**LA2-4L_ LA2-4L_-M**	**LA2-5L_ LA2-5L_-M**	**LA2-6L_ LA2-6L_-M**
Total Airflow (cfm)	680	841	1001

Acceptance: Maximum particle penetration of 0.01% for both filters; no filters leaks present.

2. Check the Inflow Velocity

Determine the inflow velocity using a Direct Inflow Measurement (DIM) method. Refer to 2.1 Direct Inflow Measurement (DIM) Method below for more details.

Take five readings:

Inlet Volumetric Flow Rate ((liter/s) / (cfm))

Avg. inflow rate (Vol) : _____ liter/s = _____ m^3/s / cfm

Aperture dimension (A) : Width x Sash height (m^2 / ft^2)

Cabinet	**LA2-3A_ LA2-3A_-M**	**LA2-4A_ LA2-4A_-M**	**LA2-5A_ LA2-5A_-M**	**LA2-6A_ LA2-6A_-M**
Width (m/ft)	0.968 / 3.18	1.270 / 4.17	1.570 / 5.15	1.870 / 6.14
Sash Height (m/ft)	0.229 / 0.75	0.229 / 0.75	0.229 / 0.75	0.203 / 0.67

Cabinet	**LA2-4L_ LA2-4L_-M**	**LA2-5L_ LA2-5L_-M**	**LA2-6L_ LA2-6L_-M**
Width (m/ft)	1.270 / 4.17	1.570 / 5.15	1.870 / 6.14
Sash Height (m/ft)	0.175 / 0.57	0.175 / 0.57	0.175 / 0.57

Inflow velocity (v) : Vol / A = _____ (m/s / fpm)

Acceptance: (For LA2-_A_/ LA2-_A_-M) - Inflow velocity must be within +/- 0.025 m/s (5 fpm) of 0.53 m/s (105 fpm) (Esco's Setpoint)

(For LA2-_L_/ LA2-_L_-M) - Inflow velocity must be within +/- 0.025 m/s (5 fpm) of 0.45 m/s (90 fpm) (Esco's Setpoint)

2.1 Direct Inflow Measurement (DIM) Method

Direct Inflow Measurement (DIM) method utilizes a calibrated Flow Hood that measured the inlet volumetric flow rate on the front aperture at nominal operating speed. The flow hood inlet is attached on the aperture, and the rest of the opening area covered by laminated paper and masking tape. The inflow velocity is obtained by dividing the volumetric inflow rate measured by Flow Hood by the width and height of the front aperture at the normal operating sash height.

The Flow Hood was set at LOCAL DENS to automatically compensate the reading for pressure and temperature, and then the reading was manually compensated for humidity by using a dew point meter.

The condition of Esco ambient-controlled test room:

Temperature : 25°C ±3°C (automatically compensated by Flow Hood)

Pressure : 1.005 bar ± 0.003 bar (automatically compensated by Flow Hood)

Dew Point : 15°C ± 3°C (manually compensated using dew point meter)

Based on this ambient condition, the Flow Hood LOCAL DENS reading was calculated to achieve the desired airflow setpoints:

$$V_{actualmoist} = \frac{P_{measured}}{P_{measured} - P_{vapor}} \times V_{dry}$$

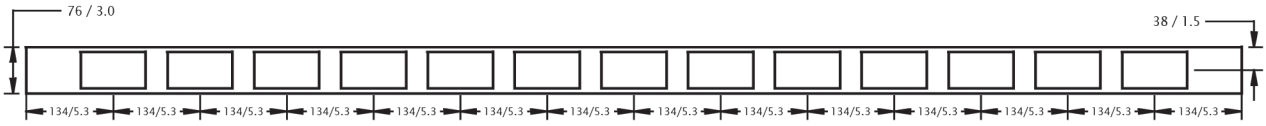
$V_{actualmoist}$: airflow corrected for humidity (desired airflow setpoint)
$P_{measured}$: measured local pressure (performed by Flow Hood)
P_{vapor} : vapor pressure (see Downflow Velocity Test in Test Report)
V_{dry} : airflow corrected for LOCAL DENS (temp. & pressure)

2.2 Secondary Inflow Measurement Method

The secondary inflow measurement method uses Esco's probe holder and gage block.

1. Remove the arm's rest. Hold the arm's rest by hand when the last capped nut is unscrewed.
2. Put the masking tape to cover the small gap between the tray and the cabinet. Mark the probe position on the masking tape

Example (units are mm / inches):



The window height is 76 mm / 3 inches, and the distance is shown in a table below:

Cabinet	**LA2-3A_ LA2-3A_-M**	**LA2-4A_ LA2-4A_-M LA2-4L_ LA2-4L_-M**	**LA2-5A_ LA2-5A_-M LA2-5L_ LA2-5L_-M**	**LA2-6A_ LA2-6A_-M LA2-6L_ LA2-6L_-M**
Width (mm/in)	968 / 38.1	1270 / 50.0	1570 / 61.8	1870 / 73.6
Distance from walls (mm/in)	121 / 4.76	127 / 5.00	121 / 4.76	134 / 5.28
Distance apart (mm/in)	121 / 4.76	127 / 5.00	121 / 4.76	134 / 5.28

3. Put the gage block and lower the sash window until it consistently touches the window height template on the left and right side of the cabinet. REMOVE the gage block before taking airflow reading.
4. Mount the thermo-anemometer on the probe holder, which along with gage block, may be obtained by contacting biotech@escoglobal.com. Attach the probe holder to the cabinet by making the magnets on the probe holder bonds to the EG steel part underneath the cabinet. Make sure the probe holder touch the front nosing of the cabinet. Adjust the probe height so that the center of the white tip is 38 mm (1.5 inches) below the sash window lower edge to take the reading at the center of the opening height.
5. Take the average of the readings. Multiply the average by the conversion factor which converts the velocity reading at 76 mm (3") constricted the normal window opening.

Cabinet	**LA2-3A_ LA2-3A_-M**	**LA2-4A_ LA2-4A_-M**	**LA2-5A_ LA2-5A_-M**	**LA2-6A_ LA2-6A_-M**
Conversion factor	0.365	0.308	0.313	0.342

If the cabinet does not have a conversion factor, then the height correction factor is applied.

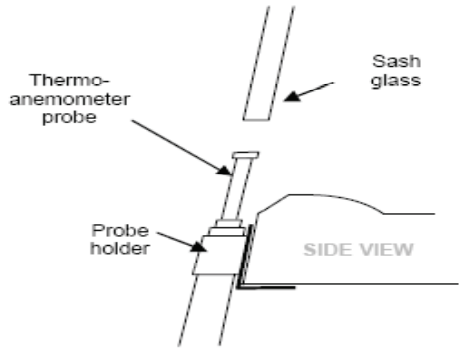
Height Correction Factor is given as:

$$V_{Nominal\_Sash\_Height} = \frac{Constricted\_Sash\_Height\_Opening}{Nominal\_Sash\_Height\_Opening} V_{Constricted\_Sash\_Height}$$

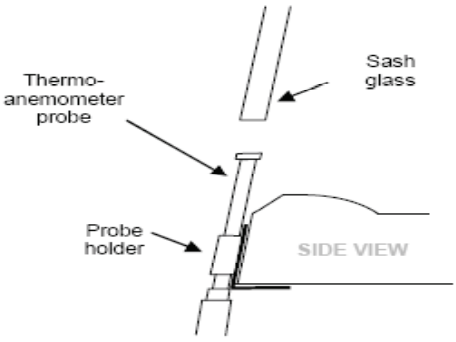
Sash window lower edge
Gage block
Probe's white tip is 38 mm (1.5 inches) from sash window lower edge
Masking tape covering the gap between tray and cabinet with marks to indicate probe position
Probe holder with magnet attached to bottom of cabinet and touching front nosing of cabinet
Recommended Thermo-anemometer: TSI Velocicalc Plus 8384
150

Note:

It is very important that the orientation of the probe with respect to the sash glass has to be correct or the inflow measurement would not be accurate. The probe must be parallel to the sash glass angle and in the same plane as the sash glass. However due to differences in manufacturing tolerances, the sash glass can be too front of the glass. Adjustments have to be made to the position of the probe.



If the sash glass is too front, clamp the thickest part of the probe with the holder so as to bring the probe outwards to be inline with the glass



If the sash glass is too back, clamp the thinnest part of the probe with the holder so as to bring the probe inwards to be inline with the glass

Acceptance criteria / testing procedures have been adopted in accordance with the requirements of the:

- NSF/ANSI 49 - 2002 Standard (Section 6.10 and Annex A Section 10)
- Canadian Standard CSA Z316.3-95 (Section 6.2)
- European Standard EN12469:2000 (Annex G and H)

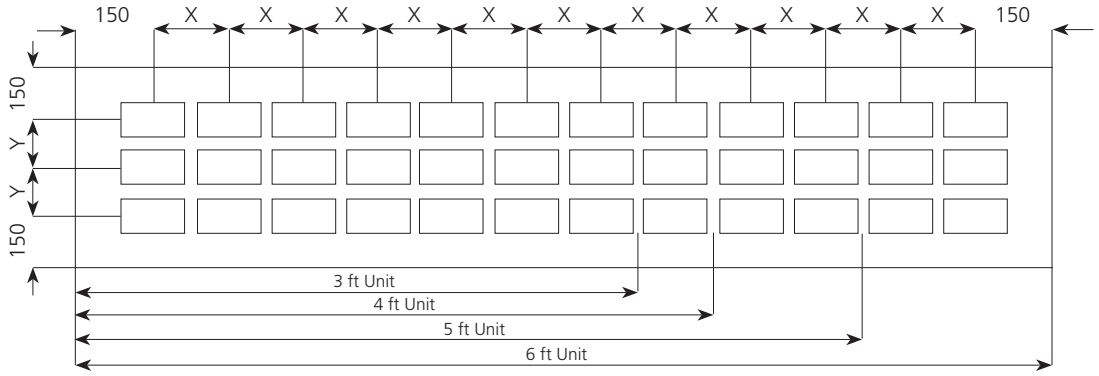
3. Check the Downflow Velocity

Acceptance criteria / testing procedures have been adopted in accordance with the requirements of the

- NSF/ANSI 49 – 2002 Standard (Section 6.9 and Annex A Section 9)
- European Standard EN12469:2000 (Annex G and H)

Take the reading with a calibrated thermo-anemometer on a plane that is 10 cm (3.9 in) above the lower edge of the sash window opening, with the UV lamp and IV bar removed. The velocity reading is compensated for Temperature, Pressure, and Humidity (Dew Point Temperature). The grid points and results (all dimensions are in mm):

3.1 Downflow Velocity Test for LA2-_A_ / LA2-_A_-M



Average : _____ m/s (fpm)

Max Deviation : _____ m/s (fpm)=_____%

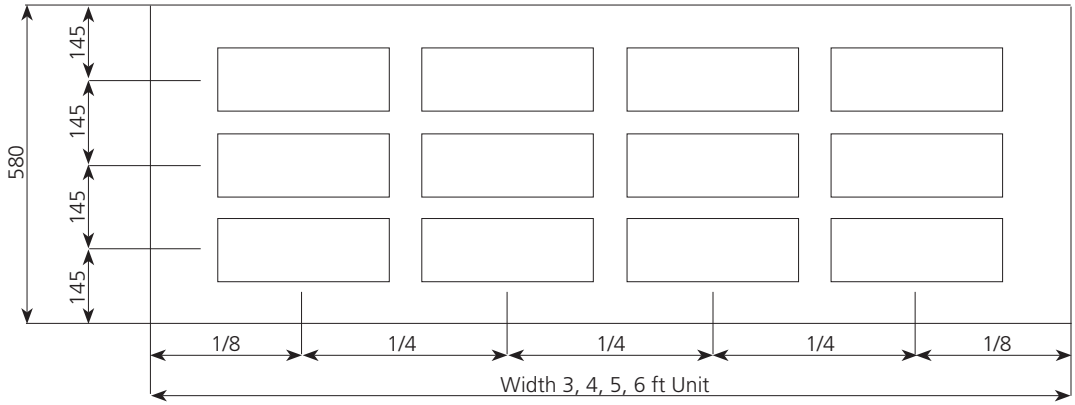
Note: *The Velocity probe must be placed with accuracy within 12.5 mm (0.5 inch) from the above grid, with correct orientation (see Probe Orientation note)*

Cabinet		**LA2-3A_ LA2-3A_-M**	**LA2-4A_ LA2-4A_-M**	**LA2-5A_ LA2-5A_-M**	**LA2-6A_ LA2-6A_-M**
Width (mm)		968	1270	1570	1870
Left to Right	Distance from walls (mm)	150	150	150	150
	Distance apart = X (mm)	110	139	141	143
Front to Back	Distance from walls (mm)	150	150	150	150
	Distance apart = Y mm)	140	140	140	140

Acceptance: Average downflow velocity must be within +/- 0.025 m/s (5 fpm) of Esco's setpoint. (3, 4, 5 feet Unit: 0.35 m/s (69 fpm) & 6 feet Unit: 0.33 m/s (65 fpm)).

All individual downflow velocity readings must be within 0.08 m/s (16 fpm) or ± 20% whichever is higher from the average.

3.2 Downflow Velocity Test for LA2-_L_ / LA2-_L_-M



Average : _____ m/s (fpm)

Max Deviation : _____ m/s (fpm)= _____%

Note: *The velocity probe must be placed with accuracy within 12.5mm (0.5 inch) from the above grid, with correct orientation (see Probe Orientation note below)*

Cabinet		**LA2-4L_ LA2-4L_-M**	**LA2-5L_ LA2-5L_-M**	**LA2-6L_ LA2-6L_-M**
Width (mm)		1270	1570	1870
Left to Right	Distance from walls (mm)	159	196	234
	Distance apart (mm)	318	393	468
Front to Back	Distance from walls (mm)	145	145	145
	Distance apart (mm)	145	145	145

Acceptance: Average downflow velocity must be within +/- 0.025 m/s (5 fpm) of 0.30 m/s (60 fpm) (Esco's setpoint). All individual downflow velocity readings must be within 0.08 m/s (16 fpm) or ± 20% whichever is higher from the average.

Note:

Probe Orientation when performing downflow test:

- *Front row: the probe was pointed to the front*
- *Middle and back row: the probe was pointed to the right on the right half of the cabinet, and is pointed to the left on the left half and center of the cabinet*

$$\ln(P_{vapor}) = -6096.9385 \times T^{-1} + 21.24 - 2.711193 \times 10^{-2} \times T + 1.673952 \times 10^{-5} \times T^{2} + 2.433502 \times \ln(T)$$

$$V_{dry} = V_{measured} \times \left[\frac{273 + T_{measured}}{273 + 21.1}\right] \times \frac{101325}{P_{measured}}$$

$$V_{actualmoist} = \frac{P_{measured} \times V_{dry}}{P_{measured} - P_{vapor}}$$

$T_{measured}$: measured temperature (°C)
T : dew point temperature (K)
P_{vapor} : vapor pressure (Pascal)
$P_{measured}$: measured pressure (mmHg)
V_{dry} : velocity in dry air (m/s)
$V_{measured}$: measured velocity (m/s)
$V_{actualmoist}$: actual / corrected velocity (m/s)

4. Perform the airflow smoke patterns test

You will need a suitable visible smoke generator to visualize cabinet airflow patterns (see the Factory Test Report for the generator used in initial factory testing).

Acceptance criteria and testing procedure have been adopted from and in accordance with the requirements of the:

- NSF/ANSI 49 – 2002 Standard (Section 6.11 and Annex A Section 11)
- Canadian Standard CSA Z316.3-95 (Section 6.5)

Downflow:

Spray smoke on work surface center line, 10cm (4”) above sash window lower edge, left to right.

Observation: Smoke flow should be smooth downward with no dead spots or reflux (upward blow).

View Screen Retention:

Spray smoke 2.5cm (1”) behind sash, 15cm (6”) above sash lower edge, left to right.

Observation: Smoke flow should be smooth downward with no dead spots, reflux (upward blow) or escape.

Work Opening Edge Retention:

Spray smoke along entire aperture perimeter, 3.8cm (1.5”) outside cabinet.

Observation: Smoke flow smooth, no reflux out once drawn in, no billowing or penetration over work surface.

Sash Wiper Seal:

Spray smoke behind sash, 5cm (2”) from the sides and along the top of the work area.

Observation: There should be no smoke escape from the cabinet.

Downflow Diffuser Perimeter:

Spray smoke at 2.5cm (1”) underneath the diffuser perimeter (this is a non-NSF test).

Observation: Smoke flow should be downward with no dead air corner or reflux.

Notes:

The sash Wiper Seal Test will require two persons to perform the test:

- *One person to insert hand into the cabinet and eject the smoke*
- *One person to check for smoke escape from the cabinet, with the front panel lifted.*

5. You are recommended to perform the following optional tests as well:

a. Operator comfort tests: light, noise, and vibration

b. Electrical safety test

c. UV intensity test

d. Personnel Protection Test (KI Method)

e. Pressure Test (Soap Bubble Test)

Esco conducts training courses on the validation and certification of biological safety cabinets. If you are interested you are most welcome to contact Esco or your nearest Esco distributor.

1.5 CALIBRATION OF SENTINEL™ CONTROL

Calibration involves measuring airflow with independent calibrated instrumentation (as the standard reference), and establishing a reference between airflow sensors on the cabinet to the standard reference.

Calibration is independent from airflow adjustment which is accomplished via speed controller (refer to Section 1.2 in the Service Section of the manual). If the cabinet airflow as measured with independent calibrated instrumentation deviate from acceptable setpoint, adjust the speed controller.

The calibration must be done in maintenance mode.

Note: *Calibration should only be performed if displayed airflow LCD display differ significantly from measured values.*

1.5.1 Setting Cabinet to Maintenance Mode

Before calibration is performed, set the cabinet to maintenance mode where the sash window can be lowered without the lights be automatically cut off. This is important because the fan voltage will slightly increase if the lights is off, resulting in a minor discrepancy in calibration. In maintenance mode, the alarms are disabled, PIN is not required every time the MENU or fan button is pressed, and no fan warm up/post purge is required.

Step	Action	Press	Display Shows
1	Press MENU button. The screen will prompt for the first number of the 4 digit PIN.	**MENU**	XXX FORMAT: 0
2	Using UP/DOWN buttons, select the first digit of the PIN number and press SET to move on.	⇕ **SET**	XXX FORMAT: 0
3	Using UP/DOWN buttons select the second digit of the PIN number and press SET to move on.	⇕ **SET**	XXX FORMAT: 00
4	Using UP/DOWN buttons select the third digit of the PIN number and press SET to move on.	⇕ **SET**	XXX FORMAT: 000
5	Using UP/DOWN buttons select the last digit of the PIN number and press SET to move on.	⇕ **SET**	XXX FORMAT: 0009
6	You will now be able to select from the available menu options. Use UP/DOWN buttons to move to the SET MODE option. Press SET button.	⇕ **SET**	SETTINGS CALIBRATION ADMIN → SET MODE
7	Using UP/DOWN button, select "Maintenance" mode from the menu and press SET. The cabinet is in maintenance mode with the LCD continuously blinking and (!) displaying to indicate unsafe condition.	⇕ **SET**	NORMAL → MAINTENANCE
8	Press the MENU button to exit from the menu	**MENU**	

1.5.2 Sensor Constant - Temperature Sensor Activation

Note: *This step needs to be performed only if the sensor is changed.*

Every sensor manufactured by Esco has a specific Sensor Constant written on the sensor sticker. This sensor constant is used for temperature compensation performed by the temperature sensor.

Step	Action	Press	Display Shows
1	Press MENU button to enter the main menu. Using the UP/DOWN buttons select CALIBRATION from the menu and press SET to enter the Calibration Menu.	**MENU** ⇕ **SET**	SETTINGS ⟶ CALIBRATION ADMIN SET MODE
2	From the menu, select SET CONSTANT and press SET.	⇕ **SET**	⟶ SET CONSTANT
3	The default sensor constant is 0. Use UP/DOWN buttons to change the sensor constant in increment of 1. Press SET to set the sensor constant value.	⇕ **SET**	CONSTANT
4	Press MENU button to exit from the menu.	**MENU**	

1.5.3 Warming Up the Speed Control

Turn the fan on. Wait for 10 minutes to allow the speed controller to warm up.

1.5.4 Calibrating the Inflow Fail Set Point

- For LA2-_A_/ LA2-_A_-M : 0.45 m/s (90 fpm) (inflow velocity)
- For LA2-_L_ / LA2-_L_-M: 0.38 m/s (75 fpm) (inflow velocity)

1. Press the MENU button. Use the ▼ button until the LCD displays "CALIBRATION". Press the SET button. The LCD will display "READ MANUAL" and "PRESS SET". Press SET again to begin calibration. Fan will be automatically turned on if it's originally turned off, and the warm-up time is 3 minutes.
2. The LCD will show :

   - "SET FAIL PT – (I)" and "I:0.45m/s (90 fpm)" alternately (LA2-_A_/ LA2-_A_-M).

   - "SET FAIL PT – (I)" and "I:0.38m/s (75 fpm)" alternately (LA2-_L_/ LA2-_L_-M)
3. Adjust the speed control and measure with meter so that the measured inflow velocity is 0.45 m/s (90 fpm) for LA2-_A_/ LA2-_A_-M (0.38 m/s (75 fpm) for LA2-_L_/ LA2-_L_-M), as shown on the LCD.
4. Once the velocity is achieved press SET. The microprocessor takes 3 minutes to record the sensor output voltage.

1.5.5 Calibrating the Inflow Nominal Set Point

For LA2-_A_/ LA2-_A_-M: 0.53 m/s (105 fpm) (inflow velocity)

For LA2-_L_/ LA2-_L_-M: 0.45 m/s (90 fpm) (inflow velocity)

1. After the above recording is done, the LCD will show:

   - "SET NOMINAL PT – (I)" and "I: 0.53m/s (105 fpm)" alternately (LA2-_A_/ LA2-_A_-M)

   - "SET NOMINAL PT – (I)" and "I: 0.45m/s (90 fpm)" alternately (LA2-_L_/ LA2-_L_-M)

2. Adjust the speed control and measure with meter so that the measured inflow velocity is 0.53 m/s (105 fpm) for LA2-_A_/ LA2-_A_-M (0.45 m/s (90 fpm) for LA2-_L_/ LA2-_L_-M) and press SET. The microprocessor takes 3 minutes to record the sensor output voltage.

1.5.6 Calibrating the Downflow Nominal Set Point (downflow velocity)

1. After the above recording is done do not change the fan speed control setting and the damper opening. The LCD will display

   - "D.VEL: 0.35 m/s (69 fpm)" (LA2-_A_/ LA2-_A_-M).

   - "D.VEL: 0.30 m/s (60 fpm)" (LA2-_L_/ LA2-_L_-M).

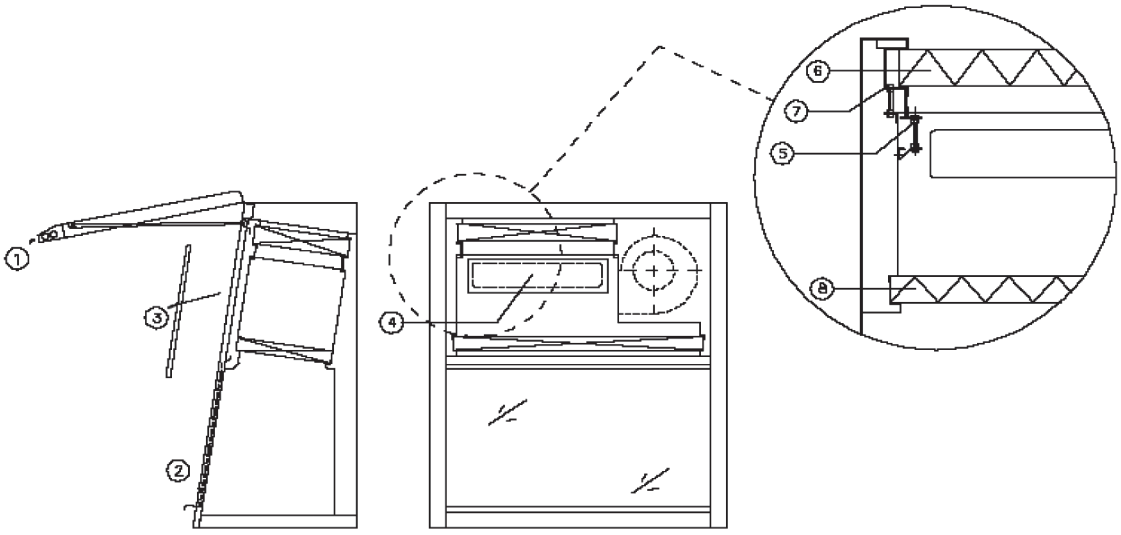
   If the downflow at nominal inflow setpoint is 0.35 m/s (69 fpm) for LA2-_A_/LA2-_A_-M (0.30 m/s (60 fpm) for LA2-_L_/ LA2-_L_-M), press the SET button. If the 0.35 m/s (69 fpm) for LA2-_A_/ LA2-_A_-M (0.30 m/s (60 fpm) for LA2-_L_/ LA2-_L_-M) downflow could not be reached, use the ▲ or ▼ button to change the downflow value. Press the SET button.

2. After the above recording is done, the LCD will show "CALIBRATION DONE" and the buzzer confirmation beep, indicating that all the points are already calibrated. If the LCD shows "CALIBRATION ERR", the calibration must be performed again. Press MENU button twice to exit from menu.

1.5.7 Setting Cabinet back to Normal Mode, and Final Checking

1. **Note:** *This first step applies only for LA2-_A_/ LA2-_A_-M*. Press MENU. Use the ▼ button to get "SETTINGS". Press SET. Use the ▼ button to get "VELOCITY UNIT". Use the ▼ button to change the unit from m/s to fpm. Press MENU twice. The displayed nominal inflow should be 105 ± 3 fpm and nominal downflow should be the downflow velocity that was entered in m/s, multiply by 2, then minus 1 fpm, with max fluctuations of ± 2 fpm. Change the unit back to m/s.
2. Press MENU button. Use the ▼ button until the LCD displays "SET MODE". Press the SET button. Use the ▼ button until the LCD displays "NORMAL". Press the SET button. Now the cabinet is in the normal mode and the LCD stop blinking.
3. Still in MENU mode, use the ▲ or ▼ button until the LCD displays "ADMIN". Press SET. Use the ▼ button until the LCD displays "RESET DEFAULT". Press SET once to select and twice to confirm. Press the MENU button twice to exit from the MENU.
4. Lower the speed control setting to the Inflow Fail Point voltage. Check if the displayed inflow velocity is 0.45 m/s (90 fpm) for LA2-_A_/ LA2-_A_-M (0.38 m/s (75 fpm) for LA2-_L_/ LA2-_L_-M) and the alarm is activated. After that, increase the speed control voltage back to the Nominal Set Point. The inflow velocity shown on LCD should be 0.53 m/s (105 fpm) for LA2-_A_/ LA2-_A_-M (0.45 m/s (90 fpm) for LA2-_L_/ LA2-_L_-M) with max fluctuations of ± 0.02 m/s (4 fpm) and the downflow velocity shown on LCD is the downflow velocity that was entered with fluctuations of ± 0.01 m/s (2 fpm).
5. At Nominal Set Point, record the sensor VDC output at the black and yellow cable ports labeled as J1AIN1 on the microprocessor board.
6. Completely block the sensor and record the time response for the alarm, which has to be less than 15 sec.

1.6 REPLACEMENT OF FILTERS



1. Remove the screws from the bottom of blue panel and then lift up the blue panel.

   Caution: *The front panel is equipped with gas spring which will open the front panel automatically.*

2. Move sash window to the lowest position

   Note: *For LA2-_A_-M / LA2-_L_-M, remove the motorized window straps before moving the sash window to the lowest position.*

3. Remove filter access panel using "+" screw driver.
4. Remove cover on positive plenum box
5. Using a #13 spanner, loosen the nut until the frame collapses all the way down along with the exhaust filter
6. Remove exhaust filter by sliding out from front
7. Using the #13 spanner, tighten the nut until the positive air plenum box is lifted up and is clear from the downflow filter
8. Remove the downflow filter by sliding out from the front
9. To replace filter, repeat the above mentioned procedure in reverse order

WARNING: *TWO PERSONS MAY BE REQUIRED FOR CHANGING THE FILTER(S) OF 5 FT AND 6 FT CABINETS*

The cabinet must undergo re-certification after changing filter.

Under normal usage and barring any accident (example - puncture), the two ULPA filters do not need replacement unless and until the inflow velocity cannot be maintained at the specifications required by the testing report even though the fan has been set to maximum speed.

The filters should not be replaced until the entire cabinet has been decontaminated. Please refer to the decontamination procedure in Section 1.11

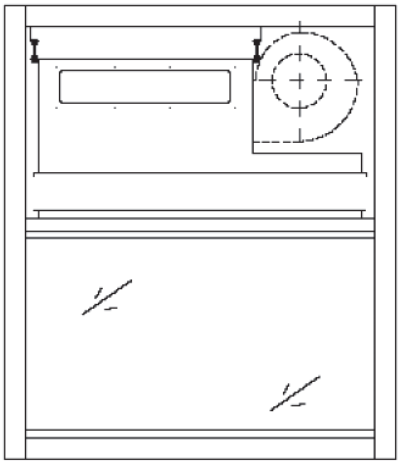
1. Before the filters are removed from the cabinet, their contaminated faces should be taped off using plastic cardboard or some other suitable material. This would minimize the risk to personnel in the event of decontamination not being thorough.
2. Used filters should be disposed off in accordance with local regulations. They may have to be incinerated as medical waste. They should be double bagged and appropriately labelled after being removed from the cabinet.
3. Proper protective attire - ideally consisting of a disposable gown, gloves, face mask, hair and shoe covers - should be worn while removing used filters. You should dispose off these things after the procedure. Finally you should properly wash your hands.
4. Before the new filters are installed, all surfaces should be thoroughly cleaned of silicon and/or adherent gasket material. The new filter should be carefully handled and examined before being fitted. It is important that the filters and the gaskets be checked for leaks prior to use.

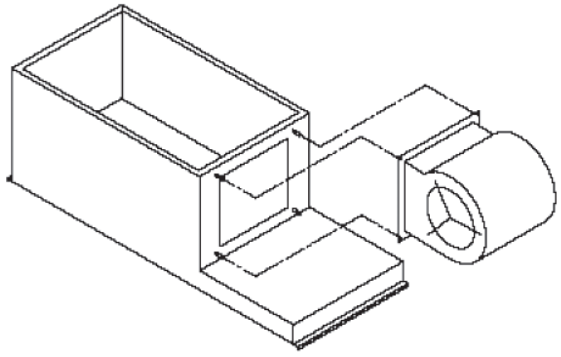
The use of non-Esco parts and / or parts not supplied directly by Esco or our authorized distributors, including but not limited to maintenance parts, spare parts, replacement parts, system components and / or system accessories, shall void all expressed or implied warranties.

1.7 REPLACEMENT OF BLOWER

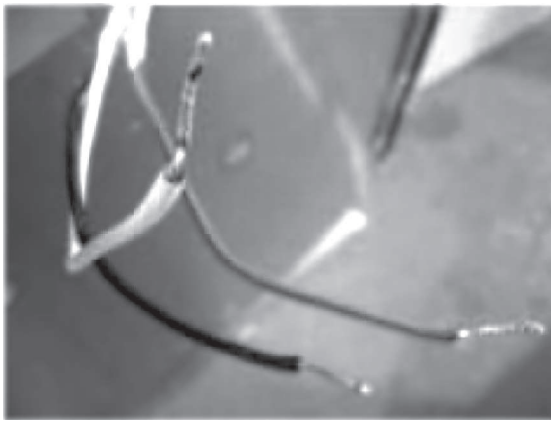
To replace the blower, follow the steps mentioned below:

1. Check the replacement parts list at the end of this manual.
2. Follow the steps that have been pictorially illustrated in the blower replacement diagram below.
3. Take out the blower housing and unscrew the bolts that secure the blower to the blower housing.
4. Repeat this procedure in reverse order with the new blower to complete the replacement.

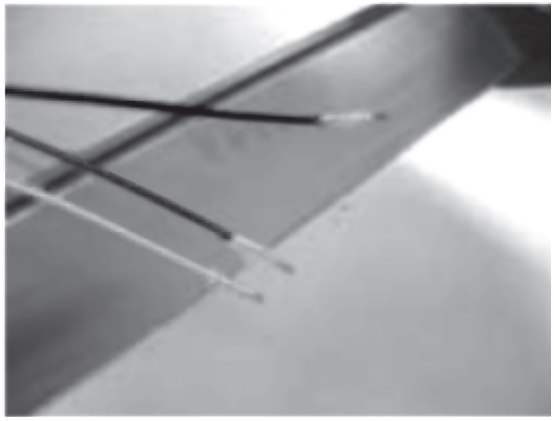




5. Please take the following precautions before you install the replacement in order to avoid any possibility of leakage in the cabinet



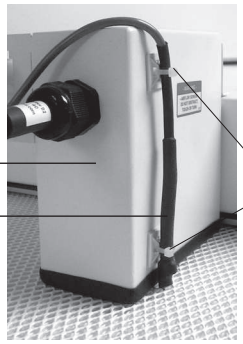
i. *Ensure that each cable has been soldered as shown in the picture on the left.*



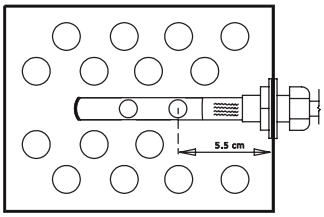
ii. *Silicon each cable that has been soldered.*

iii. *Combine the cables that have been siliconed together using silicone.*

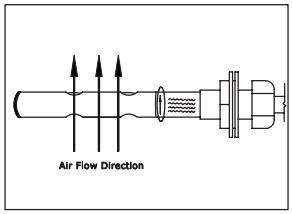
1.8 REPLACEMENT OF AIRFLOW SENSOR



1. Airflow sensor is located on top of the cabinet. Start by disconnecting the airflow sensor cable connector.
2. Cut the cable ties to remove the temperature sensor.
3. Unfasten the nut connecting the airflow sensor to the sensor housing
4. Pull out the old airflow sensor from the sensor housing.
5. Push in the new sensor. Make sure that the arrow sticker on the sensor tube is pointing "up" as shown in the figure below, so that the axes of the sensor holes are parallel to the airflow direction. Also make sure that the distance between the outer sensor hole and wall of the sensor housing is 5.5cm, as shown in the figure below:

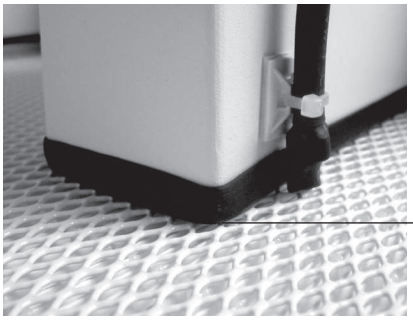


Ensure correct distance

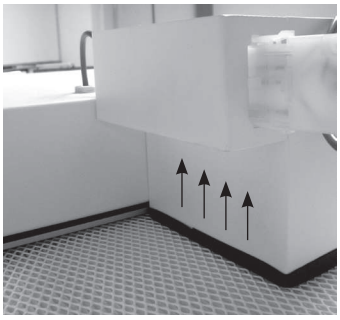


Ensure correct orientation

6. Fasten the nut and reconnect the airflow sensor cable connector. Mount back the cable onto the sensor housing. Make sure that there is no gap between the housing and the filter as shown below:

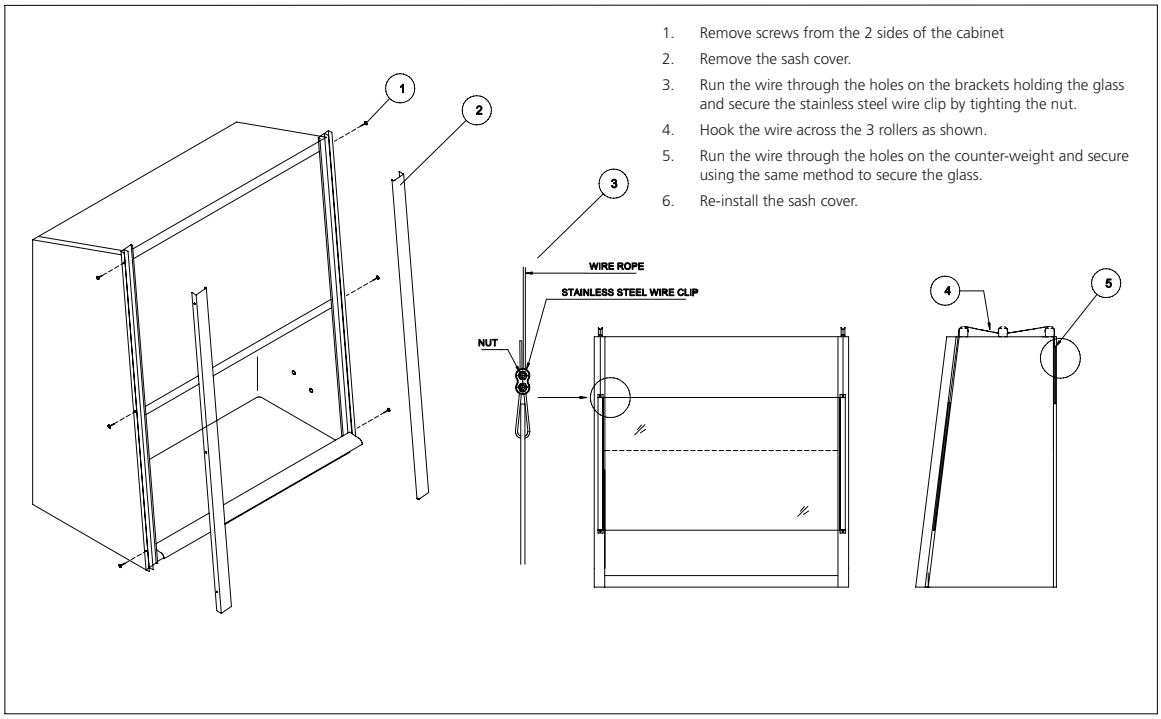


No gap between the casing and filter



When installing the airflow sensor, please watch the airflow direction

1.9 REPLACEMENT OF SASH GLASS


1. Remove screws from the 2 sides of the cabinet
2. Remove the sash cover.
3. Run the wire through the holes on the brackets holding the glass and secure the stainless steel wire clip by tighting the nut.
4. Hook the wire across the 3 rollers as shown.
5. Run the wire through the holes on the counter-weight and secure using the same method to secure the glass.
6. Re-install the sash cover.
1
2
3
WIRE ROPE
STAINLESS STEEL WIRE CLIP
NUT
4
5

Replacement of broken sash glass:

a. Remove the screws under the blue panel to open the front panel

b. Remove the 2 countersunk screws from the side front profile. Open both left and right profile covers.

c. Bring the sash glass to fully closed position that it is resting on the armrest.

d. Support the counterbalance at the back on its highest position by using a wooden bar, stacker. Make sure that the counterbalance is well supported before disconnecting the wire from the sash glass. Do not hold with hand, as the heavy counterbalance can slip down easily and injure the holder.

e. Disconnect the glass from the wires by loosening the screws on the clips (number eight shape clips).

f. Replace the glass.

g. Run the wire back to the hole and secure it with the clips. Ensure the clips are perfectly tightened.Observe the position of where the wire is previously clipped. This will help to ensure that the sash wire is connected to counterbalance evenly.

h. Remove the wood that support the counterbalance at the back to allow counterbalance to move.

i. Move the sash glass to test whether the connection is tight.

j. Place back the profile covers and secure it.

1.10 REPLACEMENT OF FLUORESCENT LAMP AND UV LAMP

Replacement of Fluorescent Lamp

1. Check the replacement parts list at the end of this manual.
2. Disconnect the electrical connections.
3. Unfasten the two screws from the bottom of the blue panel and then lift up the blue panel.

Caution: *The front panel is equipped with a gas spring which will open the front panel automatically.*

4. The fluorescent lamp(s) is located behind the blue panel. Disconnect the old one(s) and replace with the new one(s).

Replacement of UV Lamp

1. Check the replacement parts list at the end of this manual.
2. Disconnect the electrical connections.
3. Take out the old UV lamp by rotating it 90° counter clockwise and pull downward.
4. Install the new UV lamp by pushing it upward and rotating it 90° clockwise to secure the lamp in its socket.

Hazardous UV-C can be present internally. UV interlock should not be defeated at all times.

1.11 DECONTAMINATION PROCEDURE

A decontamination kit – complete with all materials, equipment and supplies, (but excluding chemicals which should be acquired locally) required for carrying out decontamination of safety cabinets - is available from Esco.

Decontamination should be performed in any of the following eventualities:

- Before replacing the exhaust/downflow filters or blower.
- Before accessing the contaminated negative or positive plenum of the cabinet.
- In case of an accidental spillage that might have contaminated any of the inaccessible surfaces
- Before performance validation and re-certification, especially if the cabinet has been used with Biological safety Level 3 or 4 agents
- Before cabinet relocation

Decontamination should only be performed by qualified personnel

1.11.1 Warning On Formalin Exposure

Decontamination is often performed by means of formaldehyde fumigation or paraformaldehyde de-polymerisation. Formalin exposure could have very dangerous implications on your health:

1. External contact can cause irritation to skin, eyes and mucous membranes
2. Inhalation in small concentration can cause coughing, nausea and diarrhoea
3. Inhalation in large concentration can cause convulsions, coma and even death
4. Long term exposure can cause cancer

Care should be taken while working with formaldehyde as it can be "reasonably anticipated to be a human carcinogen" (IARC 1982, 1987, 1995).

According to OSHA [Occupational Safety and Health Administration (USA)], formaldehyde exposure limits are as follows:

- SHORT TERM EXPOSURE LEVEL (STEL): 2 ppm for 15 minutes exposure, 4 times a day, minimum of 60 minutes in between exposures.

Any additional local safety regulations should also be observed. Personnel should be given adequate training. The following links provide general guidelines on formaldehyde safety:

- Regulations (Standards - 29 CFR) Formaldehyde - 1910.1048, Occupational Safety and Health Standards, OSHA (Occupational Safety and Health Administration), U.S. Department of Labor: http://www.osha.gov
- OSHA Formaldehyde Fact sheet (PDF format) http://www.osha.gov/OshDoc/data_General_Facts/formaldehyde-factsheet.pdf

Ammonia is used to neutralize formaldehyde. OSHA prescribes the following exposure limit for Ammonia: Ammonia STEL: 35 ppm for 15 minutes exposure, 4 times a day, minimum of 60 minutes in between exposure.

1.11.2 Common List Of Equipment Used

1. Device to measure formaldehyde concentration
   Formaldemeter® 400 has been found to be suitable and can be obtained from:
   PPM Technology (UK)
   http://www.ppm-technology.com
2. Device to measure ammonia concentration
   Dräger®-Tubes and Accuro® pumps have been found to be suitable:
   Drägerwerk AG (Germany)
   http://www.draeger.com/index.html
   Tubes with a measuring range of 0-100 ppm are recommended
3. Spore strips (optional)

1.11.3 Appropriate Protective Clothing

1. A solid front-back closing, full body, long-sleeved disposable lab gown
2. Disposable shoe covers
3. Disposable surgical/PVC gloves for hand protection

NB: *Gloves should be pulled over the knitted wrists of the gown rather than being worn inside. Double gloving should be considered. Gloves must be worn while handling formalin and ammonia solutions. Compared to latex gloves, Nitrile gloves exhibit higher resistance to formaldehyde and are less likely to cause allergic skin reactions. Hence Nitrile gloves are preferred over latex gloves.*

4. Full-faced mask with a disposable dust and mist respirator. The face shield should be wiped clean with a suitable tissue and water each time after using it.

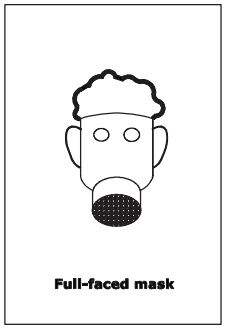


Fig. 19 *Full-faced mask*

1.11.4 Common Apparatus

a. Beaker
b. Measuring cylinder
c. Tape (3M-3939 is recommended)
d. Air-tight bag that can enclose the entire cabinet (can be ordered from Esco)
e. Measuring tape
f. Biohazard waste bag
g. Hand-drill, screwdriver, and socket key (M4 and M5)

1.11.5 Common Preparatory Steps

1. It is recommended that a safety briefing be conducted for all personnel in the laboratory where the cabinet has been placed before carrying out the procedure.
2. Access to the laboratory should be restricted during the procedure. A warning sign should be pasted on the door of the lab to warn all personnel (a suitable label is available from Esco). No personnel should enter the lab until the procedure is complete and the formaldehyde concentration has been verified to be within safe limits.

Fig. 20 *Clearly display warning signs on all doors into the lab*

3. Prior to starting the procedure, contingency plans should be drawn for possible incidences of breach in the cabinet seal, leading to leakage of formaldehyde into the room. You should properly study the ventilation design of the room and should keep appropriate equipment on standby so that formaldehyde can be vented in the event of a leakage. One way of doing this would be to connect a flexible hose to a small exhaust fan which can vent the contaminated air into an adjacent fume hood. Special care should also be taken in case the air in the laboratory is re-circulated to other parts of the building. In such a case, a formaldehyde leakage could even necessitate evacuation of other parts of the building.

4. Measure the length, width and height of the air tight bag that would be used to enclose the cabinet in order to calculate its volume. If any ductwork is used, the extra volume must also be taken into account for calculating the amount of chemicals that would be needed for carrying out the decontamination.

1.11.6 Decontamination Process

There are two alternative combinations of decontaminants and their corresponding neutralizers that are commonly used:

1. 37% formalin solution (HCHO) with 25% ammonia solution (NH_4OH) being the neutralizer
2. Paraformaldehyde with ammonium bicarbonate (NH_4CO_3) being the neutralizer

The decontamination processes carried out using these two combinations are slightly different. Both these processes are discussed in details.

There are other ways of cancelling out the effects of formaldehyde / paraformaldehyde than using the above-mentioned neutralizers. They include:

- Connecting a temporary duct to the cabinet, with the gas being released into a fume cupboard.
- Connecting a temporary duct to the external atmosphere using a temporary form connection.
- Using the existing duct connection of the cabinet to exhaust the gas (This is applicable only if the cabinet is itself ducted).

It is very important to ensure compliance with local laws and regulations with respect to the above mentioned techniques.

1.11.6.1 Formaldehyde – Ammonia Combination

Calculate the amount of 37% formalin, 25% ammonia, and water required, which is 85 ml each, for every 1 cubic meter volume to be decontaminated.

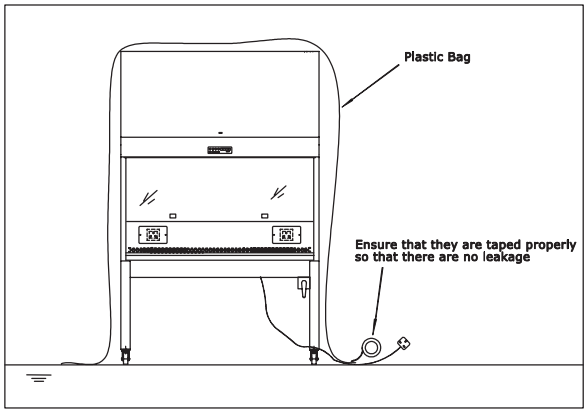
Water is poured into the formalin tank to increase the decontamination area humidity to be above 60%. If the room humidity already exceeds 60%, and the formalin tank usage needs to be optimized to decontaminate a large space, such as a small room, then there is no need to add water. Please note that the water shall not be poured into the ammonia tank because it will not assist in the decontamination process.

To anticipate a "worst case scenario", a relatively "large size" biological safety cabinet, with the body height of 1.7m (67 inches) and width of 0.9 m (35 inches), mounted on a "tall" 90 cm (35 inches) standing height support stand, will have the volume enclosed by the air tight bag, and the corresponding required solution mixture, a proximately as follows:

Cabinet Width	2ft / 0.6m	3ft / 0.9m	4ft / 1.2m	5ft / 1.5m	6ft / 1.8m
Volume (m^3)	1	1.5	2	2.5	3
37% Formalin (ml)	85	128	170	213	255
25% Ammonia (ml)	85	128	170	213	255
Water (ml) - optional	85	128	170	213	255

Smaller size cabinets, especially when installed on a 70 cm (28 inches) sitting height support stand, require less formalin, ammonia, and water than the table above.

The actual volume to be decontaminated must be measured on site, as it varies from one cabinet to another. The figures on the table above are given for comparative purpose only.



Please pay special attention to the cables.

Ensure that they are taped properly so that there are no leakages.

Fig. 21 *Completely enclose the cabinet using a plastic bag and ensure air-tightness inside the enclosure by utilizing tape in all appropriate places. Pay special attention to the power supply cables.*

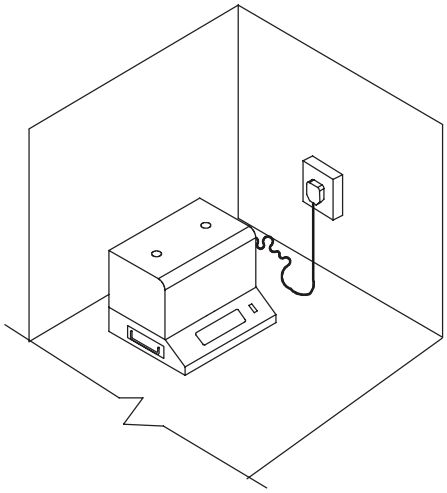


Fig. 22

- After approximately 25, 50, 75, and 100% of the formalin being evaporated, turn on the cabinet blower for 1 minute to circulate the formalin throughout the cabinet. Below is the approximate time interval to turn on the blower, corresponding to the formalin and ammonia table for the "worse case scenario" as previously discussed:

Cabinet Width	2ft / 0.6m	3ft / 0.9m	4ft / 1.2m	5ft / 1.5m	6ft / 1.8m
Volume (m3)	1	1.5	2	2.5	3
Blower ON interval	5 min	7.5 min	10 min	12.5 min	15 min

- Allow the formalin vapor a minimum contact time of 8 hours inside the cabinet, preferably 10 hours, but overnight is better (CONTACT TIME).
- The ammonia vaporizer will automatically start after the "CONTACT TIME" is finished. If possible, it's desirable to circulate the ammonia by turning on the cabinet blower at the same interval as the formalin vaporization. However, this is not required, and not as important as circulating the formalin.
- Allow the ammonia vapor a minimum neutralization time of 2 hours inside the cabinet (NEUTRAL TIME)
- After the "NEUTRAL TIME" is finished, inform the user to open the plastic bag. Please be aware that the formalin and / or ammonia concentration inside the plastic bag may be above the Short Term Exposure Level (STEL) and full face mask with formalin filter is required when opening the plastic bag.

1.11.6.2 Paraformaldehyde – Ammonium Bicarbonate Combination

Additional apparatus needed:

- ***Heating device (e.g. frying pan)***
- ***Aluminium foil***

Check temperature and humidity. The temperature inside the cabinet's work zone should be greater than 210C while the relative humidity should be in between 60% and 85%. Use a hot plate to heat a beaker of water until the desired temperature and humidity are achieved

Unless these temperature and humidity conditions are fulfilled, formaldehyde gas will not be effective. Formaldehyde enters living organisms through their cell walls by means of absorption of water

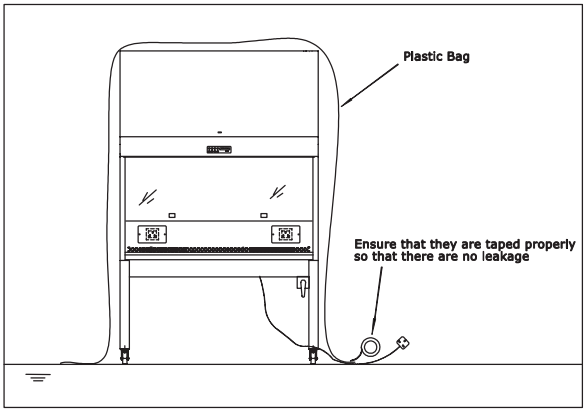
1. Based on the volume obtained in **Section 1.11.5 – point 4**, calculate the amount of paraformaldehyde and ammonium bicarbonate needed as follows:
   * Paraformaldehyde amount (gram): Total volume (m^3) x 11gram/m^3
   * Ammonium bicarbonate amount (gram):
     Steps to determine the amount of Ammonium Bicarbonate required:

a) Determine the stoichiometric amount of ammonium bicarbonate needed to produce the requisite amount of ammonia gas that would neutralize the resulting formaldehyde gas

b) To ensure completion of the reaction, make sure that the weight of ammonium bicarbonate is 10% greater than the weight of the paraformaldehyde used.

2. Typically, formaldehyde is non-penetrative. So the cabinet does not have to be pressure tight.

   Completely enclose the cabinet using a plastic bag and ensure air-tightness inside the enclosure by using tapes at all appropriate places. Pay special attention to the power supply cables.



Please pay special attention to the cables.

Ensure that they are taped properly so that there are no leakages.

Fig. 23 *Completely enclose the cabinet using a plastic bag and ensure air-tightness inside the enclosure by utilizing tape in all a propriate places. Pay special attention to the power supply cables.*

3. Wear appropriate protective clothing (Refer to **Section 1.11.3** above)
4. Spread the paraformaldehyde evenly over the surface of the heating device
5. Another heating device is placed on the work tray for the ammonium bicarbonate. At this stage, the ammonium bicarbonate should be restricted from mixing with the air in the cabinet.

The auto ignition temperature of paraformaldehyde is 3000C (5720F)

Following are two ways of restricting Ammonium Bicarbonate:

Method 1:

Spread the ammonium bicarbonate evenly over the surface of the heating device and then cover the device with aluminium foil in such a way that ammonium bicarbonate cannot react with formaldehyde while decontamination is in progress.

The aluminium foil can be placed in such a way that it allows ammonia gas to escape when the device is heated. Alternatively, some provision can be made for removing the aluminium foil remotely at the beginning of the neutralization phase.

Make sure that the deployment of such a removal mechanism doesn't lead to unsafe levels of formaldehyde escaping out of the plastic bag enclosing the cabinet.

Method 2:

Seal the cabinet using a special plastic sheet that has a pair of gloves built into it. The ammonium bicarbonate is placed in a sealed container inside the cabinet.

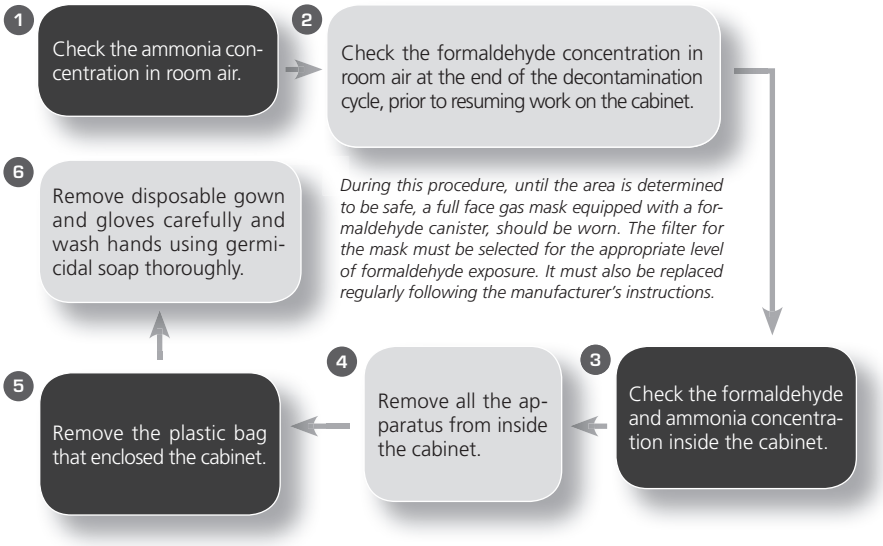
Using the built-in gloves, the person performing the decontamination would be able to reach the work zone of the cabinet without having to break the seal. At the beginning of the neutralization phase, ammonium bicarbonate is removed from the sealed container and spread evenly over the surface of the heating device. The heating device is then switched ON so that ammonia is generated from ammonium bicarbonate.

- After approximately 25, 50, 75, and 100% of the formalin being evaporated, turn on the cabinet blower for 1 minute to circulate the formalin throughout the cabinet. Below is the approximate time interval to turn on the blower, corresponding to the formalin and ammonia table for the "worse case scenario" as previously discussed:

Cabinet Width	2ft / 0.6m	3ft / 0.9m	4ft / 1.2m	5ft / 1.5m	6ft / 1.8m
Volume (m^3)	1	1.5	2	2.5	3
Blower ON interval	5 min	7.5 min	10 min	12.5 min	15 min

- Allow the formalin vapor a minimum contact time of 8 hours inside the cabinet, preferably 10 hours, but overnight is better (CONTACT TIME).
- The ammonia vaporizer will automatically start after the "CONTACT TIME" is finished. If possible, it's desirable to circulate the ammonia by turning on the cabinet blower at the same interval as the formalin vaporization. However, this is not required, and not as important as circulating the formalin.
- Allow the ammonia vapor a minimum neutralization time of 2 hours inside the cabinet (NEUTRAL TIME)
- After the "NEUTRAL TIME" is finished the time will inform the user to open the plastic bag. Please be aware that the formalin and / or ammonia concentration inside the plastic bag may be above the Short Term Exposure Level (STEL) and full face mask with formalin filter is required when opening the plastic bag.

1.11.7 Completion Steps


1
Check the ammonia concentration in room air.
2
Check the formaldehyde concentration in room air at the end of the decontamination cycle, prior to resuming work on the cabinet.
During this procedure, until the area is determined to be safe, a full face gas mask equipped with a formaldehyde canister, should be worn. The filter for the mask must be selected for the appropriate level of formaldehyde exposure. It must also be replaced regularly following the manufacturer's instructions.
3
Check the formaldehyde and ammonia concentration inside the cabinet.
4
Remove all the apparatus from inside the cabinet.
5
Remove the plastic bag that enclosed the cabinet.
6
Remove disposable gown and gloves carefully and wash hands using germicidal soap thoroughly.

1.11.8 Validation Of Decontamination Procedure (Optional)

- Place some Bacillus subtilis var.niger spore strips inside the cabinet prior to decontamination.
  * work surface/table tray
  * drain pan
  * downstream HEPA filter
- Place similar strips outside the decontamination room for positive control (optional).

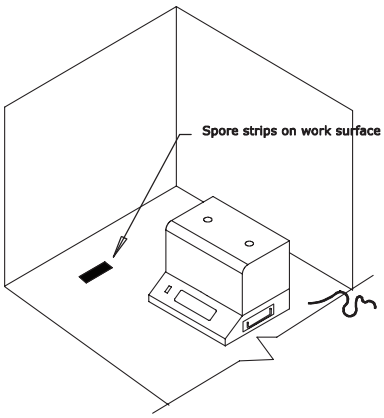


Fig. 24 *Spore strips on work surface*

- Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C.
- If there is no growth of bacteria inside the broth (the broth remains clear), the decontamination procedure has been successfully verified.

CHAPTER 2
TROUBLESHOOTING

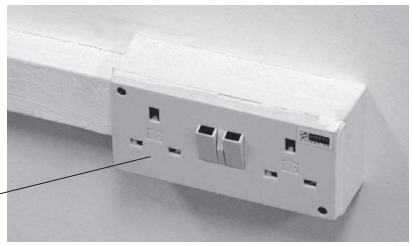
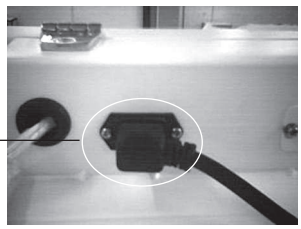
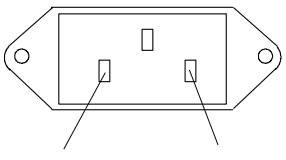
This section helps you troubleshoot some of the common problems you might face while operating this cabinet. Should you have any queries left unanswered here, please feel free to contact Esco.

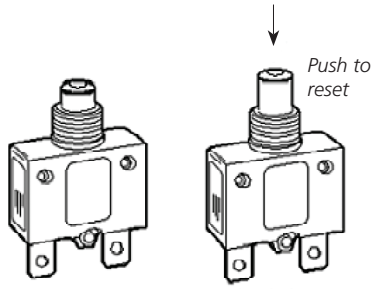
Electrical hazard. Please study the electrical circuit diagram carefully before you start using this cabinet. You can find the electrical diagram inside the electrical panel which in turn is behind the front panel.

This cabinet must be certified after installation and re-certified whenever it is moved or its performance is suspected. Besides that, cabinet should be re-certified at least once in a year (6 months if BSL-3 or 4 agents are used).

2.1 HARDWARE AND SOFTWARE TROUBLESHOOTING

2.1.1 Hardware Troubleshooting

<table>
<tr><th>Problem</th><th>Possible Cause</th><th>Corrective Action</th></tr>
<tr><td rowspan="4">Cabinet does not start (LCD, button, fan, light, UV, and socket are all inoperative)</td><td>Power Failure</td><td>• Check if there is power at the wall/building socket.
• You can use voltmeter or test pen to check power on the wall/ building socket.</td></tr>
<tr><td colspan="2">Wall socket
(Sample of Singapore socket)
 
1-1</td></tr>
<tr><td>Power cord is not connected properly or faulty</td><td>• Check whether power cord has been connected properly into wall/ building socket and also into the unit. Some cabinet has 2 cords.
• Check whether the power cord is giving power, measure the AC voltage between the live and the neutral terminal of the cord by using voltmeter (see drawing 1-3).
• If the voltage is NOT within +/-2% of the wall socket voltage, replace the cord.
• If the voltage is within +/-2% of the wall socket voltage, please proceed to next step.</td></tr>
<tr><td colspan="2">Electrical cord
 
1-2
 
LIVE NEUTRAL
1-3</td></tr>
</table>

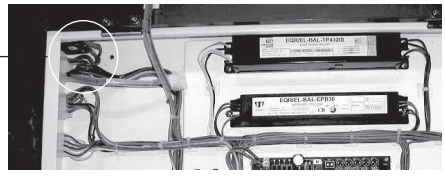
Cabinet does not start (LCD, button, fan, light, UV, and socket are all inoperative)	Circuit breaker has tripped	• If there is power on wall socket and cord, check whether circuit breaker has tripped. • To access the circuit breaker, open the front of the cabinet and locate the electrical panel with the RED cover behind it. • Circuit breaker is located inside this electrical panel. See drawing Layout A or Layout B at the end of this section to find circuit breaker. **Note:** *If circuit breaker has tripped, do not reset the breaker before checking all electrical components and wiring connections. (See drawing 1-4).* • Does the cabinet operate correctly after resetting the circuit breaker? If not proceed to next step.
		 *Circuit breaker (normal condition)* *Circuit breaker (tripped condition)* **1-4**
	Improper connection	• Lift-up the front panel and locate electrical box (with red metal cover) behind it. • Open electrical box and ensure cabinet is plugged in. • Carefully measure AC voltage between any LIVE and NEUTRAL pin on the terminal block inside electrical box (see drawing 1-5). • The voltage should be 230V, AC or 115V, AC +/- 10%. • See drawing Layout A or Layout B at the end of this section to locate connector A and find pin numbering system of the connector. • If the voltage is out of the range, check cable connection at connector A pin 1,2 and 3 (for LA2-_A1) or connector A pin 1,3, and 5 (for LA2-_A2). • At connector A, confirm the voltage is correct. For LA2-_A1, AC voltage between pin 1 and 2 must be 230V, AC +/-10%. For LA2-_A2, AC voltage between pin 1 and 3 must be 115V, AC +/- 10%. See Table 1 below.

Voltage	Connector A Pin Connections			Ground
	1	2	3	
230V, AC +/-10%	✓	✓		3
115V, AC +/-10%	✓		✓	5

Table 1

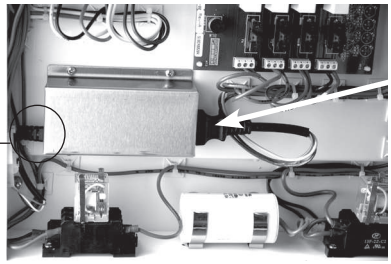
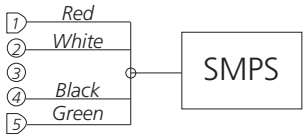
115V, AC / 230V, AC

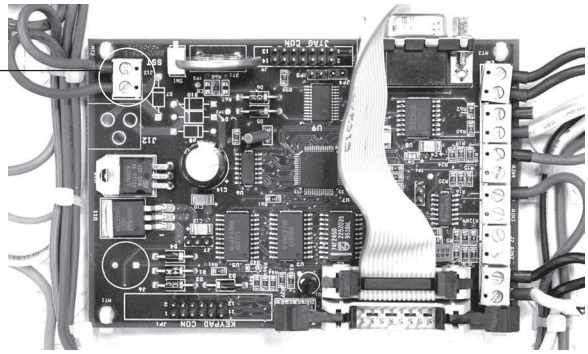
1-5

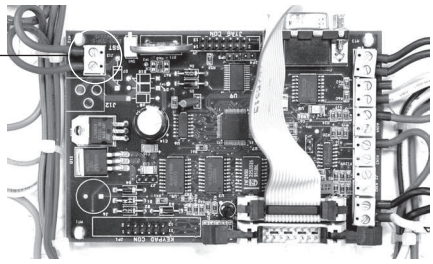


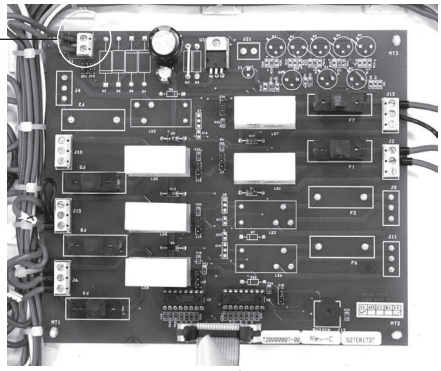
Connector A

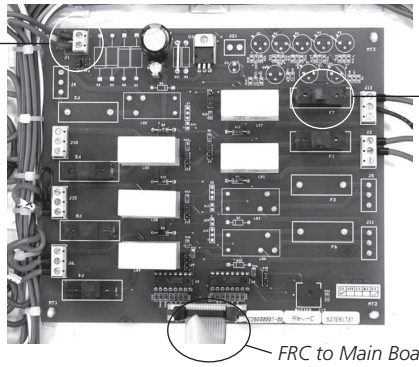
1-6

<table>
<tr><td rowspan="4">Cabinet does not start (LCD, button, fan, light, UV, and socket are all inoperative)</td><td>Defective power supply (SMPS)</td><td>• Unit must be turned on to perform this test.
• See drawing Layout A or Layout B at the end of this section to locate the SMPS. It is inside the electrical panel and covered by a stainless steel box.
• Checking SMPS output: Disconnect the 5-pin connector attached to the SMPS output then measure the DC voltage between Red (pin 1) and White (pin 2) cables on the SMP side. See drawing 1-7 below.
• The voltage should be in range of +7.5VDC +/- 10%.
• If out of range, please check incoming power to the SMPS Molded cord into SMPS – check terminal where the cord is connected. The input of SMPS should be 230V, AC +/- 10% for LA2-_A1 or 115V, AC +/- 10% for LA2-_A2. If input is correct but output is not, then replace the SMPS.</td></tr>
<tr><td colspan="2">SMPS output Red-White = 7.5VDC
 
1-7
SMPS Input 115V, AC / 230V, AC
5P Connector Male
 

1-8</td></tr>
<tr><td>Connection problem to main board</td><td>• See drawing Layout A or Layout B at the end of this section to locate the main board inside electrical box.
• Measure the incoming voltage on the Main Board at terminal J 13 (Note polarity, BLUE wire closest to edge is negative (-)). See drawing 1-9 below to locate terminal J 13.
• Voltage should be between 6.75 – 8.25VDC.
• If voltage is out of range, check connection between SMPS and main board.
• If voltage is correct, proceed to next step.</td></tr>
<tr><td colspan="2">Terminal J13 Red-Blue = 7.5VDC
 
1-9
MAINBOARD</td></tr>
</table>

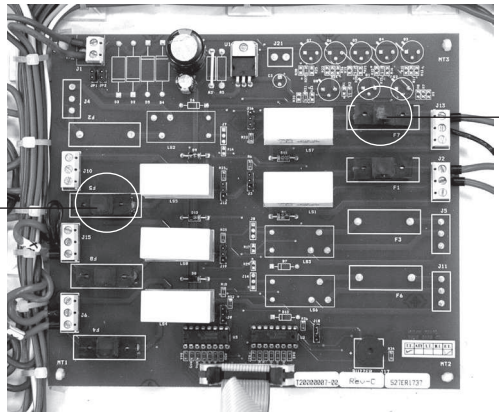
<table>
<tr><td rowspan="4">Cabinet does not start (LCD, button, fan, light, UV, and socket are all inoperative)</td><td>Defective main board</td><td>• Restart the cabinet 2 to 4 times.
• The Main Board is defective if the Main Board incoming supply is between 6.75 – 8.25VDC and:
- All LED's on the control panel are off
- The LCD is blank
- There is no Buzzer sound
• If these conditions exist replace the main board.
Note: When replacing main board, please reconnect all the wires back correctly. Any wrong wiring may result in damage.
• If these conditions DO NOT exist proceed to next step.</td></tr>
<tr><td colspan="2">Terminal J13
Red-Blue = 7.5VDC
 
1-10
MAINBOARD

LCD
1-11
LED MEMBRANE</td></tr>
<tr><td>Connection problem to relay board</td><td>• See drawing Layout A or Layout B at the end of this section to locate the relay board inside electrical box.
• Measure the incoming voltage on the Relay Board at terminal J1 (Note polarity, BLUE wire closest to edge is negative (-)). See drawing 1-12 below to locate terminal J1.
• Voltage should be between 6.75 – 8.25VDC.
• If voltage is out of range, check connection between SMPS and relay board.
• If voltage is correct, proceed to next step.</td></tr>
<tr><td colspan="2">Terminal J1
Red-Blue = 7.5VDC
 
1-12
RELAY BOARD</td></tr>
</table>

<table>
<tr><td rowspan="2">Cabinet does not start (LCD, button, fan, light, UV, and socket are all inoperative)</td><td>Defective relay board</td><td>• Ensure the following are correct:
- Main Board is operational
- Flat Ribbon cable is installed correctly to relay board and main board and shows no physical damage
- Relay board has the correct incoming voltage (6.75 – 8.25VDC)
- Check all fuses on relay board: Turn off power, remove fuses and physically inspect or check continuity.
• Turn the cabinet on, if the FAN, LIGHT, SOCKET and UV cannot be controlled, replace the Relay Board.
Note: When replacing relay board, please re-connect all the wires back correctly. Any wrong wiring may result in damage.</td></tr>
<tr><td colspan="2">Red-Blue = 7.5VDC
 
Fuse
FRC to Main Board
1-13</td></tr>
<tr><td rowspan="3">Motor is silent</td><td>Fan is Off</td><td>• Switch on the Fan by pressing Fan button on control panel.
• Enter the Fan PIN number if required (default is 0001)
• The LED for FAN should illuminate and the FAN should start.
• If the FAN does not work, proceed to next step.
• If the LED does not illuminate, check connection from control panel to main board or replace the membrane.</td></tr>
<tr><td colspan="2">

2-1</td></tr>
<tr><td>Fuse F1 is blown</td><td>• Switch off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board inside electrical box.
• Check Fuse F1 on relay board. See drawing 2-2 below.
• If fuse F1 is blown, as temporary solution, use F5 to replace F1. The fuse F5 is not used and is a spare fuse.
• If fuse F1 is ok, proceed to next step.</td></tr>
</table>

Motor is silent



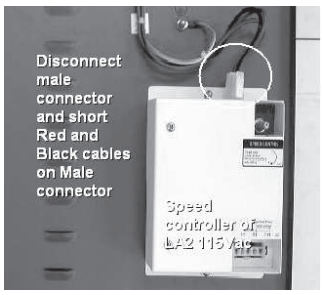
2-2

RELAY BOARD

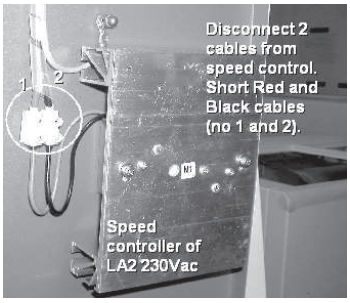
Faulty motor speed controller	• Switch off the cabinet. • Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the motor speed controller. It is attached on the cover. • Add a jumper wire between the 2 cables going to speed control. See drawing 2-3, 2-4, 2-5, 2-6 and Table 2 below. • Switch on the cabinet. • If the fan operates properly, you can conclude that the speed controller is defective and need to be replaced. • If the fan does not operate, the problem is not with the speed controller, proceed to next step.

Voltage	Drawing
230V, AC +/- 10%	2-4, 2-6
115V, AC +/- 10%	2-3, 2-5

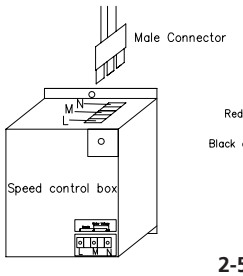
Table 2

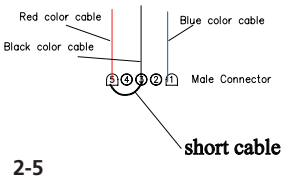


2-3

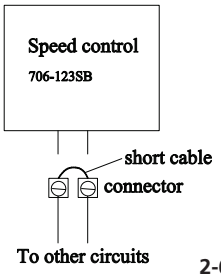


2-4

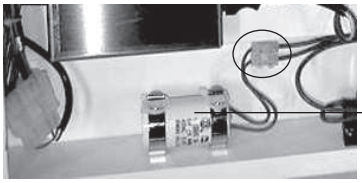




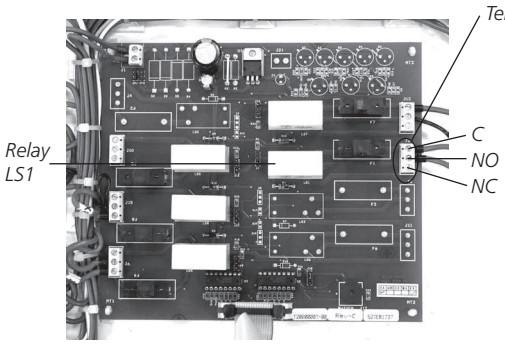
2-5



2-6

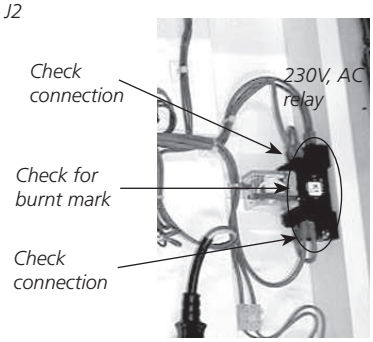
<table>
<tr><td rowspan="3">Motor is silent</td><td>Faulty capacitor</td><td>
• Switch the unit off.
• See drawing Layout A or Layout B at the end of this section to locate the capacitor inside electrical box.
• See drawing 2-7 below, disconnect two cables of capacitor.
• Using a capacitance meter or a Voltmeter set to capacitance measurement record the value between two capacitor cables.
• Correct value is shown in Table 3 below. If the value is out of given ranges, replace it.
• If the capacitance is within the given ranges proceed to next step.
Warning: The capacitor may still have some electrical charges if the cabinet was switched on prior doing this checking. Wait for 1-2 minutes and check the capacitor voltage using a voltmeter to ensure the capacitor were discharged (voltage less than 5V, AC) prior to disconnecting the capacitor.
</td></tr>
<tr><td colspan="2">
Disconnect 2 cables from capacitor. Measure capacitor's capacitance using multimeter.


2-7
<table>
<tr><th>Voltage</th><th>Capacitance</th></tr>
<tr><td>230V, AC +/- 10%</td><td>13 - 15 µF</td></tr>
<tr><td>115V, AC +/- 10%</td><td>37 - 43 µF</td></tr>
</table>
Table 3
</td></tr>
<tr><td>Faulty relays</td><td>
• Turn off the cabinet
• Check LS1 relay on the Relay Board. See Drawing 2-8 below.
• Make sure all wiring and connections are correct.
• On terminal J2, check the NO to Common and NC to Common circuits by checking continuity.
• If the NO to Common and NC to Common contacts are not correct, replace the Relay Board.
• If the NO to Common and NC to Common contacts are correct, proceed to the next step.
• Check K1 relay, see drawing Layout A or Layout B at the end of this section to locate the K1 relay.
• With cabinet still switched-off, check if the cables connected to the relay socket are tight. See drawing 2-9 below.
• Visually inspect the relay for burnt contacts or flask marks on the inside of the relay case (Relay is the one with transparent, rectangular, plastic case)
• Check NO to Common and NC to common contacts on relay K1. The method is same as for LS1 relay.
• If the relay K1 shows signs of arching (burnt marks) or the NO-C and NC-C circuits are not correct, replace the relay.
</td></tr>
</table>



RELAY BOARD

2-8

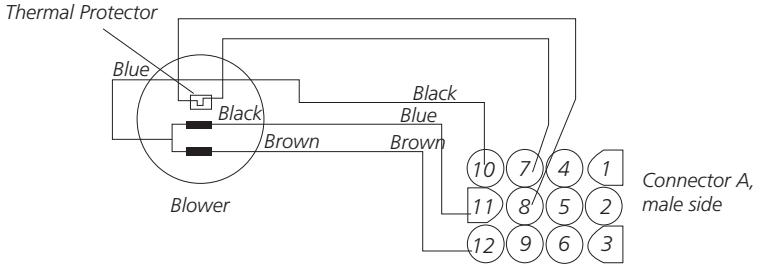


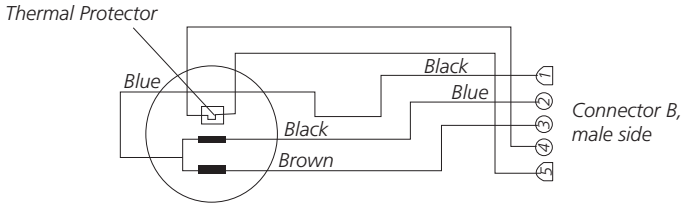
2-9

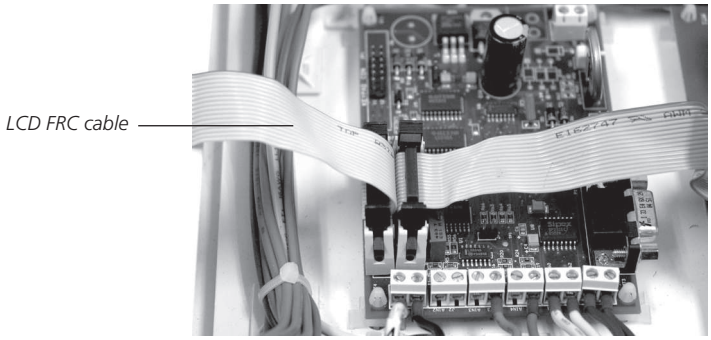
Motor is silent	Auto-thermal cut-off	• Check the Fan for overheating – The motor has an in-built thermal cut off. • Wait 60 minutes with the FAN turned off and then try to restart. • If the FAN restarts determine why there is excessive heat in the cabinet. • If the FAN does not restart proceed to the next step
	Motor failure	• Turn off the unit. • Check motor resistance by disconnecting connector A or B on electrical box. See Table 4, drawing 2-10, and drawing 2-11 below. • Use a multimeter to measure the DC resistance between following pin on male connector A or B. • If measurement is not correct, check motor condition. • To replace the motor, please follow instruction which is available in this manual under Service Section.

Voltage	Connector	Pin		DC Resistance
230V, AC +/-10%	A (12-pin)	10	11	Less than 100 ohms
		10	12	Less than 100 ohms
		11	12	Less than 100 ohms
		7	8	Zero ohm
115V, AC +/-10%	B (5-pin)	1	2	Less than 100 ohms
		1	3	Less than 100 ohms
		2	3	Less than 100 ohms
		4	5	Zero ohm

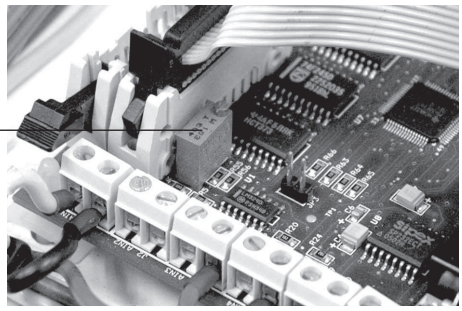
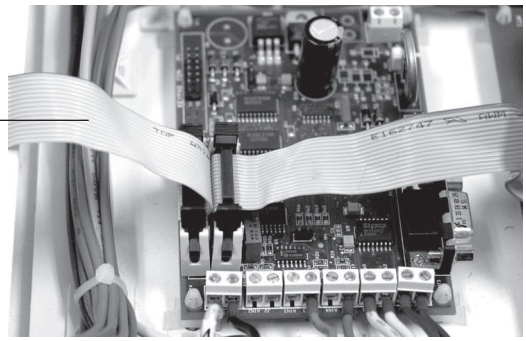
Table 4

<table>
<tr>
<td>Motor is silent</td>
<td colspan="2">


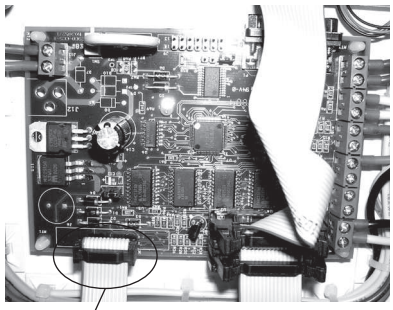
Fan connection on 230V, AC cabinet 2-10


Fan connection on 115V, AC cabinet 2-11
</td>
</tr>
<tr>
<td rowspan="3">Blank LCD</td>
<td>Connection problem</td>
<td>
• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the main board inside electrical box.
• Check whether LCD FRC (Flat Ribbon Cable) has been inserted properly into its socket on the main board. See drawing 3-1 below.
</td>
</tr>
<tr>
<td colspan="2">


3-1
</td>
</tr>
<tr>
<td>Contrast problem</td>
<td>
• Turn on the cabinet.
• Adjust the potentiometer on main board by rotating the top metal part using flat screw driver to achieve the best LCD contrast. Anti clock-wise direction will increase the contrast. See drawing 3-2.
• If the LCD remains blank, replace it.
</td>
</tr>
</table>

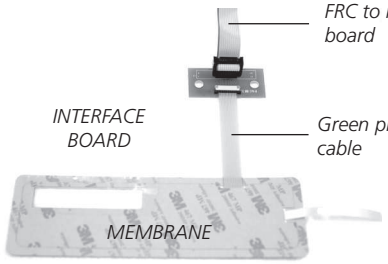
<table>
<tr><td rowspan="3">Blank LCD</td><td colspan="2">Potentiometer
 
MAIN BOARD
3-2</td></tr>
<tr><td>Defective LCD</td><td>• Connect a new LCD to the LCD port on main board (refer to possible cause 1 above on how to find the LCD port).
• If the new LCD functions properly, means the old one is defective. Replace it. To replace LCD, need to uninstall the fluorescent light and its metal deflector first.
• If the new LCD is not working, check its cable or replace the main board.</td></tr>
<tr><td colspan="2">LCD FRC cable
 
3-3</td></tr>
<tr><td>Inoperative buttons</td><td>Connection problem</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the main board inside electrical box.
• See drawing 4-1 and ensure FRC cable going to interface board is connected properly. The triangle sign on the female connector indicates PIN number 1.
• Interface board and membrane/keypad are located behind the blue panel, underneath the light metal deflector.
• With the cabinet still turned-off, uninstall the fluorescent light and metal deflector to access the interface board. See drawing 4-3.
• See drawing 4-2 for the proper connection between main board, interface board, and membrane/keypad.
• Check if the green plastic cable from the membrane has been inserted properly into the interface board. Follow drawing 4-4 for the correct orientation of connector.</td></tr>
</table>

Inoperative buttons

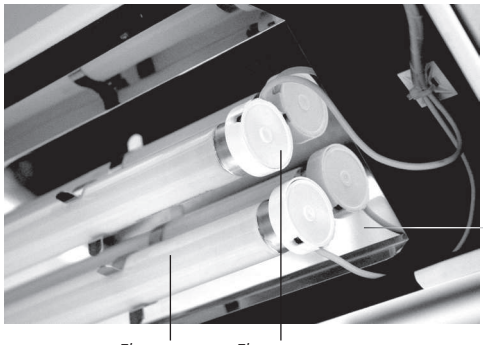


Cable to interface board

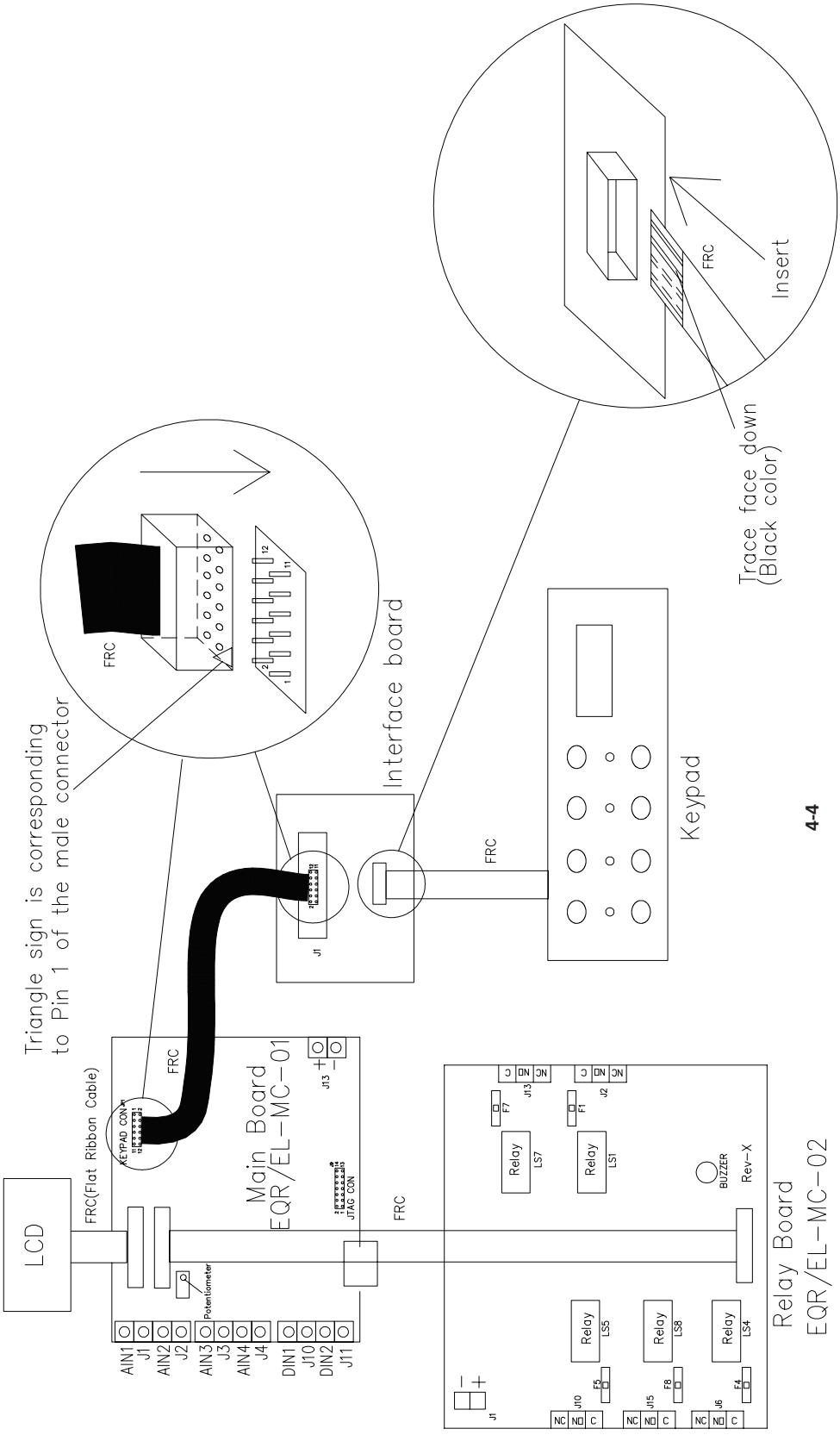
4-1

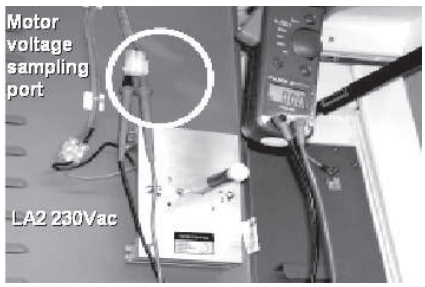


4-2

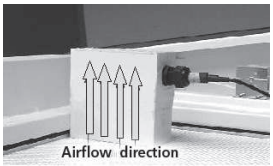
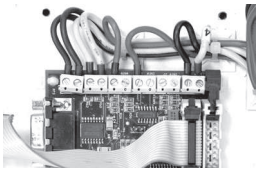
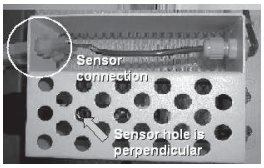


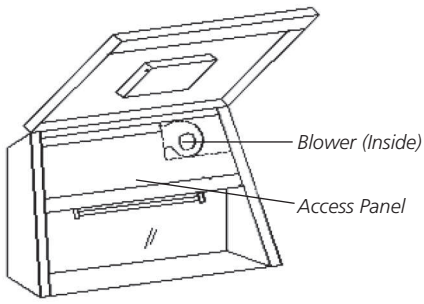
4-3

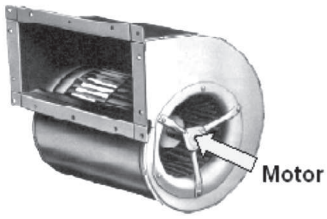

Triangle sign is corresponding
to Pin 1 of the male connector
FRC
Interface board
Trace face down
(Black color)
FRC
Insert
FRC
Keypad
4-4
FRC(Flat Ribbon Cable)
KEYPAD CON
FRC
Main Board
EQR/EL-MC-01
JTAG CON
FRC
LCD
Potentiometer
AIN1 J1
AIN2 J2
AIN3 J3
AIN4 J4
DIN1 J10
DIN2 J11
Relay LS7
Relay LS1
BUZZER
Rev-X
Relay LS5
Relay LS8
Relay LS4
Relay Board
EQR/EL-MC-02

Inoperative buttons	Defective Cable and / or Interface Board and / or keypad	• Replace them one by one, to check which one(s) among them is/are defective. • Replace the defective part(s).
Airflow Failure (AIRFAIL) - alarm is triggered (this could be due to either hardware or software)	External air interference	• Ensure that there is no external sources of airflow disturbance like air conditioner vent, window or incidences of door opening or people walking fast near the cabinet. • If there is no external air interference, proceed to next step.
	Blocked cabinet grille	• Ensure that the front and back air grilles inside the cabinet are not blocked and that the cabinet is not excessively loaded. • If there is no blocked air grille, proceed to next step.
		 5-1
	Low building supply voltage (if new cabinet, check this first)	• Turn off the cabinet. • Open the front panel and locate electrical box behind it. • Open electrical box and see drawing 5-2 and 5-3 below to locate motor voltage sampling port. • Using voltmeter, measure AC voltage at the motor voltage sampling port as described in the re-certification section of this manual. This is to measure the blower's supply voltage. • If the supply voltage is lower than the Nominal Voltage value recorded in test report, adjust the speed control to get output voltage to blower as specified in the Test Report – Test Conditions Documentation Sheet. • If supply voltage is same as Nominal Voltage, proceed to next step.
		 **5-2** **5-3**

Airflow Failure (AIRFAIL) - alarm is triggered (this could be due to either hardware or software)	Filter loaded or wrong speed controller setting	• Turn off the cabinet. • Open electrical box and see drawing 5-2 and 5-3 to locate motor voltage sampling port. • Plug in the voltmeter to the Motor Voltage Sampling Port. • Turn the Speed Control to increase the blower voltage by approximately 10V, AC and wait about 2-3 minutes. • Measure the actual airflow velocity using anemometer or flowhood, if actual airflow is ok but LCD still shows AIRFAIL, go to next step. If actual airflow is not ok, please adjust motor speed controller accordingly until actual airflow is ok, after this, if LCD still shows AIRFAIL, go to next step. **Note:** *The cabinet must be certified at least annually.* • If the blower is already operating at maximum voltage and the airflow alarm is still triggered due to filter loaded, it's time to change the filter. Instruction on how to replace the filter is available in this manual under Service Section. • If filter is not loaded, proceed to next step.
	Faulty/ inaccurate calibration	• Re-calibrate the microprocessor. Follow the calibration procedure available in the factory test report. **Warning:** *To be carried out only by an authorized person.* **CHECKING CALIBRATION DATA** • After calibration is done, go to MENU, key in PIN if required, choose SET MODE, choose MAINTENANCE. • LCD will blink in MAINTENANCE MODE. • Go to main display by pressing MENU button twice. • Press SET button, LCD will display software version that is currently being used on the cabinet. Example: C104A V2.2. • Press DOWN button until you find below message: - ADC A/F: this is the realtime/actual airflow sensor voltage - ADC D/Z: this is the airflow sensor voltage when fan is OFF (no airflow) - D/N VEL: this is the nominal downflow velocity (0035 means 0.35m/s). This value is keyed in manually during calibration process. - ADC I/F: this is the airflow sensor voltage when inflow is at fail point (0.45m/s) - ADC I/N: this is the airflow sensor voltage when inflow is at nominal point (0.53m/s) - ADC TEMP: this is the temperature sensor voltage - TEMP: this is the temperature read by temperature sensor (in °C) - CONSTANT: this is the airflow sensor constant • In order to prevent any AIRFAIL or unstable velocity displayed on LCD problem, please ensure the followings after the calibration done: 1. CONSTANT value is correct. Check it with constant written on sensor body or inside Replaceable Component Record List which come with test report. 2. TEMP shows room temperature. If not, refer to Problem Airflow Failure - Sensor Failure / Sensor Misalignment. 3. ADC D/Z < ADC I/F < ADC I/N. If not please re-do calibration in correct sequence: SET CONSTANT -> SET ZERO -> CALIB. Difference between ADC D/Z and ADC I/F, and between ADC I/F and ADC I/N, must be higher than 80. If not, the velocity displayed on LCD will be unstable. Please re-do the calibration and wait for 2 minutes longer for each calibration step. If result still the same, try to shift airflow sensor position in or out about +/- 5mm, the re-do the calibration. 5. Just after calibration, ADC A/F value should be close to ADC I/N value.If not, please adjust the speed controller to make them closer by at least +/- 20.

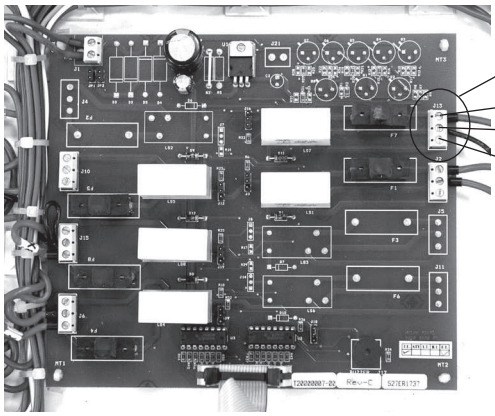
Airflow Failure (AIRFAIL) - alarm is triggered (this could be due to either hardware or software)	Fluctuating Voltage	• Measure and check voltage stability of the wall/building supply. • If the building supply voltage fluctuates more than the stated tolerance (+/- 2%), connect the cabinet to a voltage stabilizer. • If the building supply voltage fluctuation is below +/-2%, proceed to next step.
	Sensor Failure / Sensor Misalignment	**A. Air Flow Sensor failure / misalignment** • Airflow sensor is located on top of the unit, above exhaust filter and installed inside white metal box. See drawing 5-4. It is a stainless steel tube with 2 round holes facing up. **Important to check:** 1. Ensure that the sensor area is not blocked at all and that its through-holes are perpendicular to the filter's surface. 2. Sensor is attached tightly to the box. 3. There is no gap between sensor box and filter surface. 4. Sensor box is installed tightly to the cabinet. • Turn off the cabinet. • Open the front panel and locate electrical box behind it. • Open electrical box and see drawing Layout A or B at the end of this section to locate the main board inside electrical box. • Using multimeter, check the sensor's output voltage (DC) at channel AIN1(+) and J1(-) on main board (see drawing 5-5). • The voltage should increase if motor voltage is increased and decrease if motor voltage is decreased. • If your observation is different, check sensor connection on top of the unit (see drawing 5-6 below) for any bad/loose connection. • If connection is ok but sensor is still not working properly, replace it. • If airflow sensor is working properly, proceed to next step. **B. Temperature Sensor Failure** • Temperature sensor is located on top of the unit, close to airflow sensor, and attached on the white metal box. See drawing 5-7. • Using multimeter, check the temperature sensor's output voltage (DC) at channel AIN4(-) and J4(+) on main board (see drawing 5-5). • 0.01VDC should represent one degree Celsius. For example, if output is 0.25VDC, it indicates temperature of 25 degree C. Tolerance of +/- 1 degree C is acceptable. • Replace temperature sensor if the reading is wrong. • If temperature sensor is working properly, proceed to next step.
		 **5-4**  **5-5** *Main board*  **5-6** **5-7**

<table>
<tr><td rowspan="2">Airflow Failure (AIRFAIL) - alarm is triggered (this could be due to either hardware or software)</td><td>Motor failure</td><td>• Check the motor. If motor is not running, refer to ‘motor is silent’ problem.
• If motor is working properly, proceed to next step.</td></tr>
<tr><td>Others</td><td>• Please refer to software troubleshooting section for more information.
• There is an option to disable the airflow alarm monitor by going into MENU, then choose ADMIN, then choose A/F MONITOR, then choose DISABLE.
Warning: When airflow alarm is disabled, the control system will not generate any alarm when airflow is dropped below fail point. This step must only be done by authorized personnel.</td></tr>
<tr><td rowspan="3">Excessive fan noise</td><td>Resonance</td><td>• Lift-up the front panel and locate electrical box (with red metal cover) behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the speed controller inside electrical box. Refer to drawing 5-2 and 5-3 above.
• Increase the motor speed by 5 – 10V, AC. Check whether the noise disappeared. If noise disappeared, measure the actual airflow velocity. If the velocity is still in the acceptable range, keep it. If velocity is out of acceptable range or if noise persists, replace the blower.</td></tr>
<tr><td>Loose motor or impeller wheel mounting</td><td>• Refer to the previous Motor Is Silent --> Faulty Capacitor Section, to check the capacitor, and replace if necessary.
Warning: For next step, decontaminate the unit before accessing to blower. To be carried out only by an authorized person.
• After docontamination, open the blower access panel (see drawing 6-1) and check if the blower mounting bolts have been fully tightened.
• Also check whether the motor can rotate properly and not loose. (See drawing 6-2).
• If motor is physically damaged, replace it.</td></tr>
<tr><td colspan="2"> 

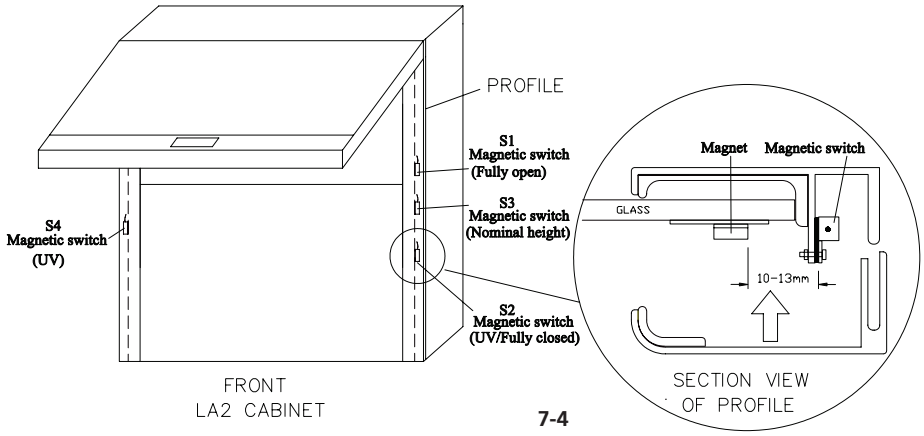
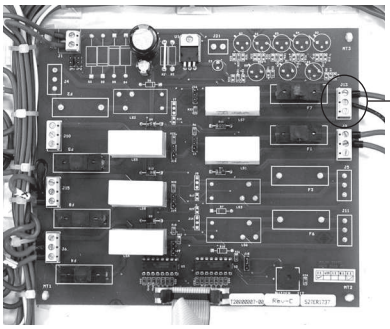
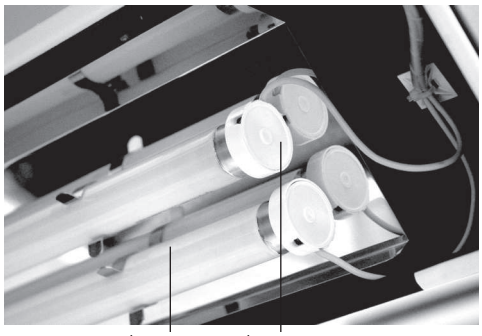
6-1 LA2-_A_
 

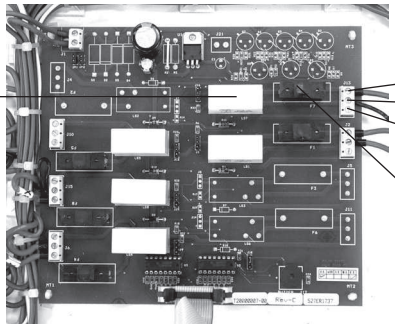
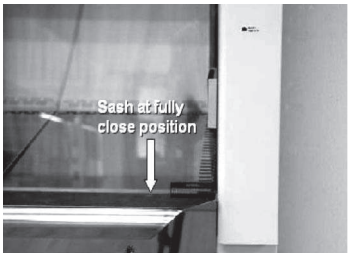
6-2</td></tr>
<tr><td>Light always OFF</td><td>Sash in SASH ALARM or UV state</td><td>• Move the sash to Ready position (normal operating height).
• Ready position is indicated by black dot mark on the right profile cover (see drawing 7-1).
• Switch on the light by pressing LIGHT button on the membrane keypad (see drawing 7-2).
• Light can only be ON at Ready or Fully Open sash position.
• If light can not be ON when sash at Ready position, proceed to next step.</td></tr>
</table>

<table>
<tr><td rowspan="4">Light always OFF</td><td colspan="2">
- WARNING -
No biohazard protection when sash is not at nominal height
SASH HEIGHT
Sash at ready position
Right profile cover
7-1

7-2</td></tr>
<tr><td>Faulty fluorescent tube</td><td>• Replace the faulty fluorescent tube.
• Fluorescent tube is located inside the blue panel (see drawing 7-6 below).</td></tr>
<tr><td>Faulty Fluorescent ballast</td><td>• Turn off the cabinet.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the fluorescent ballast, connector C, and relay board inside electrical box.
• Turn on the cabinet, then turn on the light by pressing LIGHT button on membrane/keypad.
• Check AC voltage at ballast input (between pin NO on J13 terminal on relay board to neutral), see drawing 7-3 below.
• It should be 230V, AC +/- 10% for 230V cabinet or 115V, AC +/- 10% for 115V cabinet.
• If not, check the LS7 relay and F7 fuse. Refer to drawing 7-7.
• Turn off the unit.
• Disconnect male connector C on electrical box.
• Turn on the unit.
• Turn on the light, then check AC voltage at ballast output (between female connector C pin 1 and 2), it should be around 450-600V, AC. See Table 5 below.
• Replace ballast if output voltage is much lower than this range.</td></tr>
<tr><td colspan="2"> 

7-3
<table>
<tr><th>Connector C</th><th>Voltage</th></tr>
<tr><td>Pin 1 to 2</td><td>450-600V, AC</td></tr>
</table>
Table 5</td></tr>
</table>

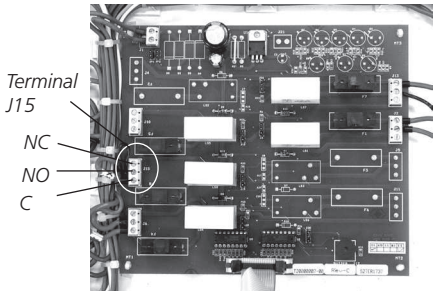
Light always OFF	Ready magnetic switch is faulty or misaligned	• Move sash to Ready position. The LCD should show either "FAN OFF" or showing velocity. • If the LCD showing "SASH ALARM" instead, please open the right profile cover where sash alarm mark located by unscrewing the 2 screws. See drawing 7-1 above. • There are 3 magnetic switches inside the right profile. See drawing 7-4 below. The one in the middle is for Ready position. • You will find a magnetic strip attached on the glass just beside the middle switch. • Shift the switch or magnet position so the distance between them is between 10-13mm as explained in drawing 7-4 below. If the distance is too far, the switch may not be able to detect the magnet. • If the LCD still showing "SASH ALARM", the switch may be faulty (please replace it) or the connection may have problem. For checking on connection, follow next step.
	 **7-4**	
	Connection Problem	• Turn off the cabinet. • Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board, fluorescent ballast, and connector C inside electrical box. • Check for any loose or bad connection between relay board, fluorescent lamp ballast, and female connector C. • See drawing 7-5 to locate terminal J 13 on relay board, check tightness of 2 cables connected to J 13. • For connector C, disconnect the male side from electrical box, then check male and female side for any bad connection. • Check also connection of the lamp holder (see drawing 7-6).
	 *Black cable is ballast input (230V, AC or 115V, AC)* **7-5** *Terminal J13*  *Fluorescent lamp tube* *Fluorescent lamp holder* **7-6**	

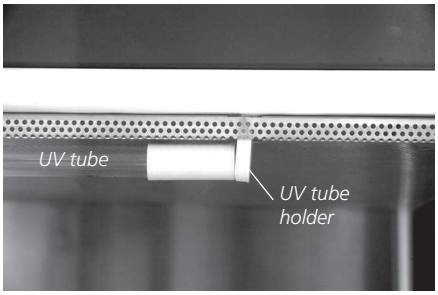
<table>
<tr><td rowspan="3">Light always OFF</td><td>Faulty relay or fuse</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board inside electrical box.
• Check relay LS7 and fuse F7 on the relay board. See drawing 7-7 below.
• If fuse F7 is blown, as temporary solution, use F5 to replace F7. The fuse F5 is not used and is a spare fuse.
• On terminal J 13, check the NO to Common and NC to Common circuits by checking continuity.
• If the NO to Common and NC to Common contacts are not correct, replace the Relay Board.</td></tr>
<tr><td colspan="2">Relay LS7
 
C
NO
NC
Fuse F7
7-7</td></tr>
<tr><td rowspan="3">UV Light always OFF</td><td>Sash not in UV state</td><td>• Lower the sash to UV mode position (fully closed, see drawing 8-1 below).
• If UV MODE is not displayed on the LCD, please refer to the Magnetic Switch troubleshooting section.
• Switch on the UV lamp by pressing the UV button (see drawing 8-2 below).
• If UV MODE is displayed on LCD but UV is not on after pressing UV button, please refer to the Magnetic Switch troubleshooting section.</td></tr>
<tr><td colspan="2"> 

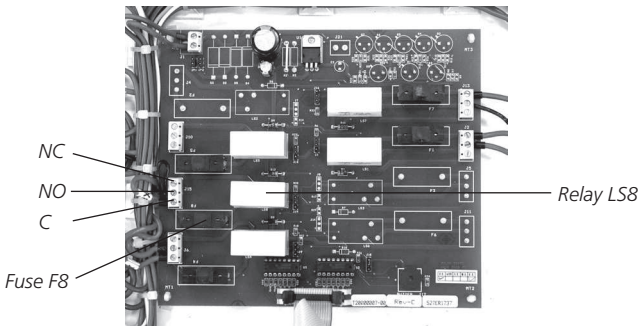
8-1

UV button
8-2</td></tr>
<tr><td>Faulty UV light</td><td>• Replace the faulty UV light. Note: Typical UV light life is 8000 hours.</td></tr>
</table>

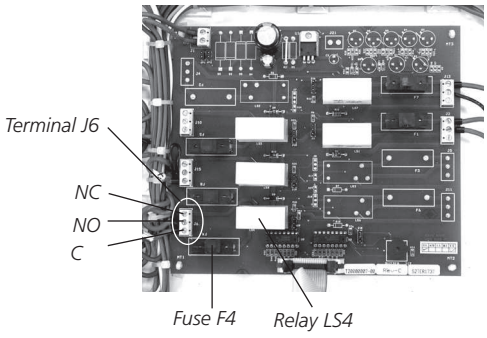
<table>
<tr><td rowspan="3">UV Light always OFF</td><td>Faulty UV ballast</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the UV ballast, relay board, and connector B for 230V, AC cabinet or connector E for 115V, AC cabinet inside electrical box.
• Turn on the cabinet, then switch on the UV by pressing UV button on membrane/keypad.
• Check AC voltage at UV ballast input (between pin NO on J15 terminal on relay board to neutral), see drawing 8-3.
• It should be 230V, AC +/- 10% for 230V, AC cabinet or 115V, AC +/- 10% for 115V, AC cabinet.
• If not, check the LS8 relay and F8 fuse. Refer to drawing 8-5.
• Turn off the unit.
• Disconnect male connector B or E on electrical box.
• Turn on the unit.
• Turn on the UV, then check AC voltage at ballast output (between female connector B pin 7 and 8 for 230V, AC cabinet or between female connector E pin 7 and 8 for 115V, AC cabinet), it should be around 10-25V, AC for 230V, AC cabinet or around 450-600V, AC for 115V, AC cabinet. See Table 6 below.
• Replace ballast if output voltage is out this range.</td></tr>
<tr><td colspan="2"><table>
<tr><th>Cabinet Voltage</th><th>Connector</th><th>Pin</th><th>UV ballast output</th></tr>
<tr><td>230V, AC +/-10%</td><td>B</td><td>7 to 8</td><td>10-25V, AC</td></tr>
<tr><td>115V, AC +/-10%</td><td>E</td><td>7 to 8</td><td>450-600V, AC</td></tr>
</table>Table 6</td></tr>
<tr><td>UV magnetic switch is faulty or misaligned</td><td>• Move sash to Fullly Closed position. The LCD should show “UV MODE”. Please ensure that the sash is fully closed.
• If the LCD showing “SASH ALARM” instead, please open the right profile cover where sash alarm mark located by unscrewing the 2 screws. See drawing 7-1 above.
• There are 3 magnetic switches inside the right profile. See drawing 7-4 above. The bottom one is for UV Mode position.
• You will find a magnetic strip attached on the glass just beside the bottom switch.
• Shift the switch or magnet position so the distance between them is between 10-13mm as explained in drawing 7-4 above. If the distance is too far, the switch may not be able to detect the magnet.
• If the LCD still showing “SASH ALARM”, the switch may be faulty (please replace it) or the connection may have problem. For checking on connection, follow next step.
• If LCD is showing UV MODE after adjustment but you are still unable to switch the UV ON by pressing UV button. Please open the left profile cover where there is one magnetic switch inside as shown in drawing 7-4 above.
• Do the same checking and adjustment as magnetic switch on bottom right.
• If UV still can not be ON, the switch may be faulty (please replace it) or the connection may have problem. For checking on connection, follow next step.</td></tr>
</table>

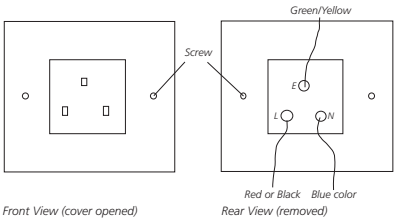
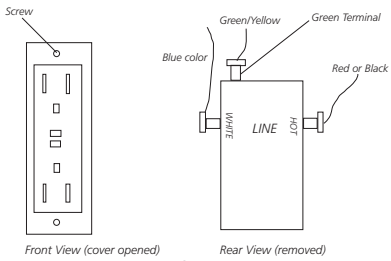
<table>
<tr><td rowspan="4">UV Light always OFF</td><td>Connection Problem</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board, UV ballast, and connector B for 230V, AC cabinet or connector E for 115V, AC cabinet inside electrical box.
• Check for any loose or bad connection between relay board, UV lamp ballast and female connector B or E.
• See drawing 8-3 to locate terminal J 15 on relay board, check tightness of 2 cables connected to J 15.
• For connector B or E, disconnect the male side from electrical box, then check male and female side for any bad connection.
• Check also connection of the UV lamp holder (see drawing 8-4).</td></tr>
<tr><td colspan="2"> 

Black cable is UV ballast (230V, AC or 115V, AC)
8-3
 

8-4</td></tr>
<tr><td>Faulty relay or fuse</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board inside electrical box.
• Check LS8 relay and fuse F8 on the relay board. See drawing 8-5 below.
• If fuse F8 is blown, as temporary solution, use F5 to replace F8. The fuse F5 is not used and is a spare fuse.
• On terminal J 15, check the NO to Common and NC to Common circuits by checking continuity.
• If the NO to Common and NC to Common contacts are not correct, replace the Relay Board.</td></tr>
<tr><td colspan="2"> 

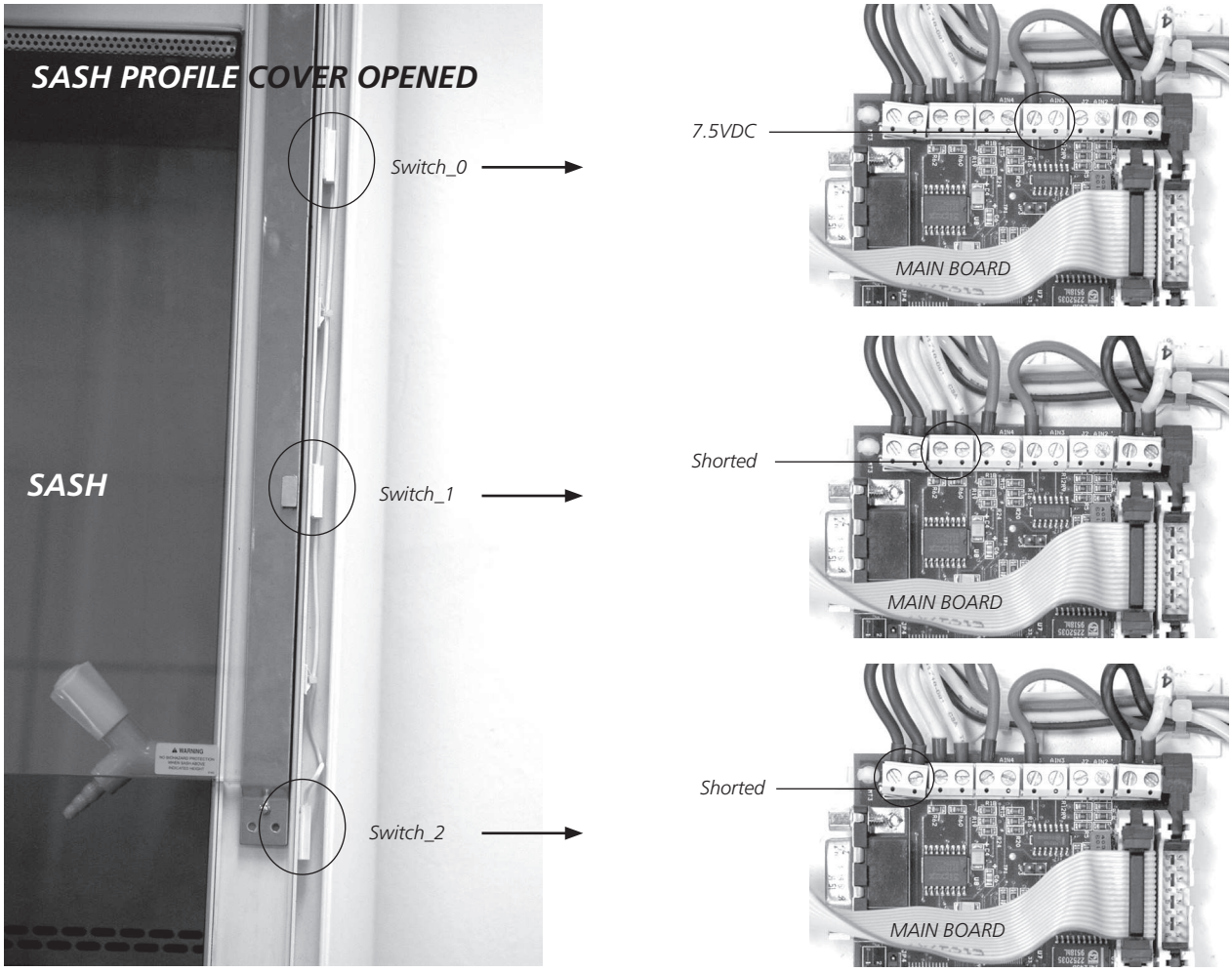
8-5</td></tr>
</table>

<table>
<tr><td rowspan="4">Electrical Socket always OFF</td><td>Connection problem</td><td>• Turn off the cabinet.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board and connector B for 230V, AC cabinet or connector E for 115V, AC cabinet inside electrical box.
• Check for any loose or bad connection between relay board and female connector B or E.
• See drawing 9-2 below to locate terminal J 6 on relay board, check tightness of 2 cables connected to J 6.
• For connector B or E, disconnect the male side from electrical box, then check male and female side for any bad connection.
• Check also connection on electrical socket, it is located inside the workzone (see drawing 9-1 below).</td></tr>
<tr><td colspan="2">
Electrical outlet
9-1</td></tr>
<tr><td>Faulty relay or fuse</td><td>• Turn off the cabinet.
• Open the front panel and locate electrical box behind it.
• Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the relay board inside electrical box.
• Check LS4 relay and fuse F4 on the relay board. See drawing 9-2 below.
• If fuse F4 is blown, as temporary solution, use F5 to replace F4. The fuse F5 is not used and is a spare fuse.
• On terminal J 6, check the NO to Common and NC to Common circuits by checking continuity.
• If the NO to Common and NC to Common contacts are not correct, replace the Relay Board.
• If the NO to Common and NC to Common contacts are correct, proceed to the next step.</td></tr>
<tr><td colspan="2"> 
Terminal J6
NC
NO
C
Fuse F4
Relay LS4
9-2</td></tr>
</table>

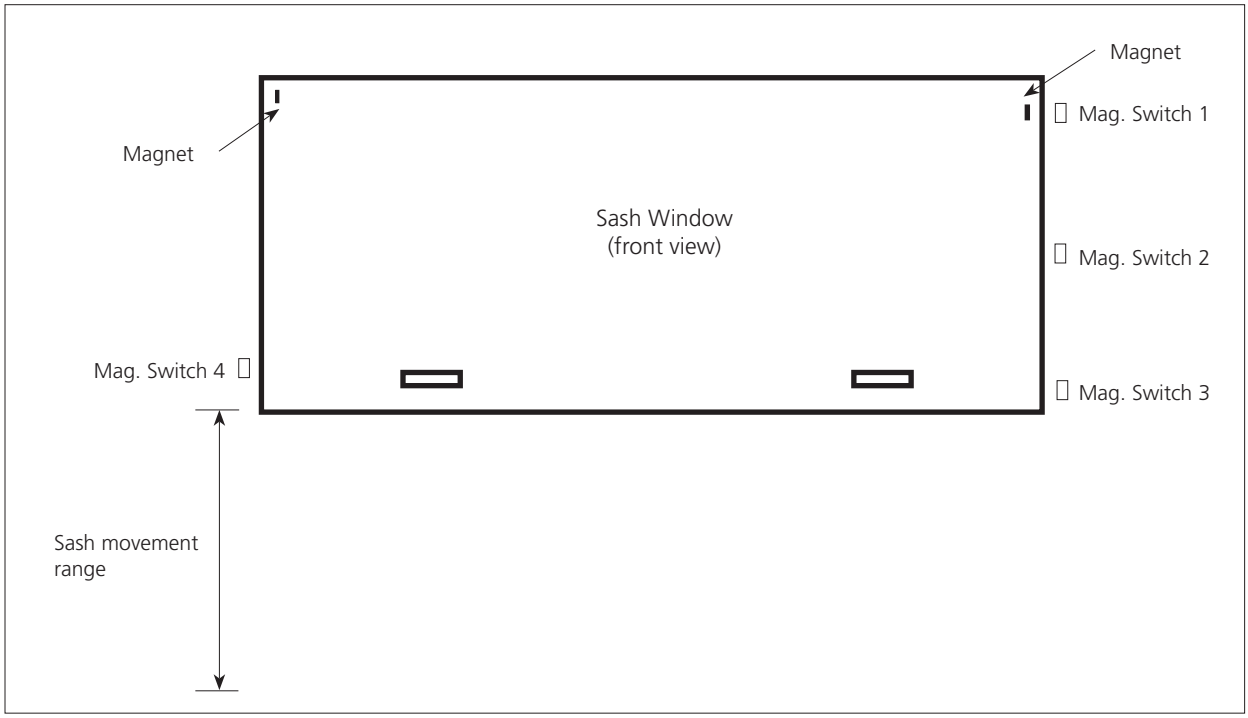
Electrical Socket always OFF	Faulty electrical socket	• Socket is located inside the workzone. See drawing 9-1. • Check electrical socket connection. Refer to drawing 9-3 and 9-4 below. • If connection is correct but socket has no output, replace it.
	Socket on 230V cabinet  **9-3** *Socket on 115V cabinet*  **9-4**	
Contaminated samples	Blocked air grille	• Make sure that the front and back air grilles are not blocked. See drawing 5-1.
	Low airflow	• Adjust the speed control (located inside the electrical panel, behind the front panel) and / or damper (if present, located on top of the unit, above exhaust filter) to get the optimum airflow as stated in the test report.
	Leaking downflow filter	• Decontaminate the cabinet and change the downflow filter. • Re-certify the cabinet after the new filter has been installed.
	Leaking exhaust filter	• Exhaust filter is located on top of the unit. • Patch the leaking filter with 3M DP-100 glue. • The patched area should not exceed 4% of the total filter area. • Then check the filter for leakage again. • If the filter is still leaking, decontaminate the cabinet and change the exhaust filter. • Re-certify the cabinet after the new filter has been installed.

2.1.2 Software Troubleshooting

Error Codes	Explanation	Corrective Action
ERR. MSWITCH	MAGNETIC switch error.	• Magnetic switches are located inside right profile cover. See drawing B-1 below. **A. Check for faulty Magnetic switch(es):** • Turn on the unit. • On control panel, press MENU button and key in ADMIN password (if any). • Choose SET MODE option, then choose MAINTENANCE. • Press MENU to exit menu. • Press SET button to read diagnostic message. • Press DOWN button until you find below information: - Switch_0, it is ON when sash is fully opened. Switch_0 is connected to port J3 on main board inside electrical panel. Refer to drawing Layout A or Layout B at the end of this section to locate main board. When switch_0 is activated, J3 will have 7.5VDC. - Switch_1, it is ON when sash is at normal operating height. Switch_1 is connected to port J10 on main board inside electrical panel. Refer to drawing Layout A or Layout B at the end of this section to locate main board. When switch_1 is activated, port DIN1 and J10 on main board are shorted. - Switch_2, it is ON when sash is fully closed. Switch_2 is connected to port J11 on main board inside electrical panel. Refer to drawing Layout A or Layout B at the end of this section to locate main board. When switch_2 is activated, port DIN2 and J11 on main board are shorted. • If all Switches are off, the sash is in a position that would trigger the sash alarm. • Check the actual state of the magnetic switches and observe their corresponding signals on the main board (remove the sash profile to access the magnetic switches). • The magnetic switch working principle can be seen in drawing B-2 and table 7 below. • Replace any faulty switches. **B. Check for faulty main board of Sentinel™ control:** • Turn off the cabinet. • Open the front panel and locate electrical box behind it. • Open electrical box and see drawing Layout A or Layout B at the end of this section to locate the main board inside electrical box. • Remove the connection from J3, DIN1, J10, DIN2, and J11 on main board. • Switch on the system. • If the LCD does not show "SASH ALARM", the main board is faulty. • If the LCD show "SASH ALARM", the main board is ok.


SASH PROFILE COVER OPENED
Switch_0
SASH
Switch_1
Switch_2
7.5VDC
MAIN BOARD
Shorted
MAIN BOARD
Shorted
MAIN BOARD

B-1

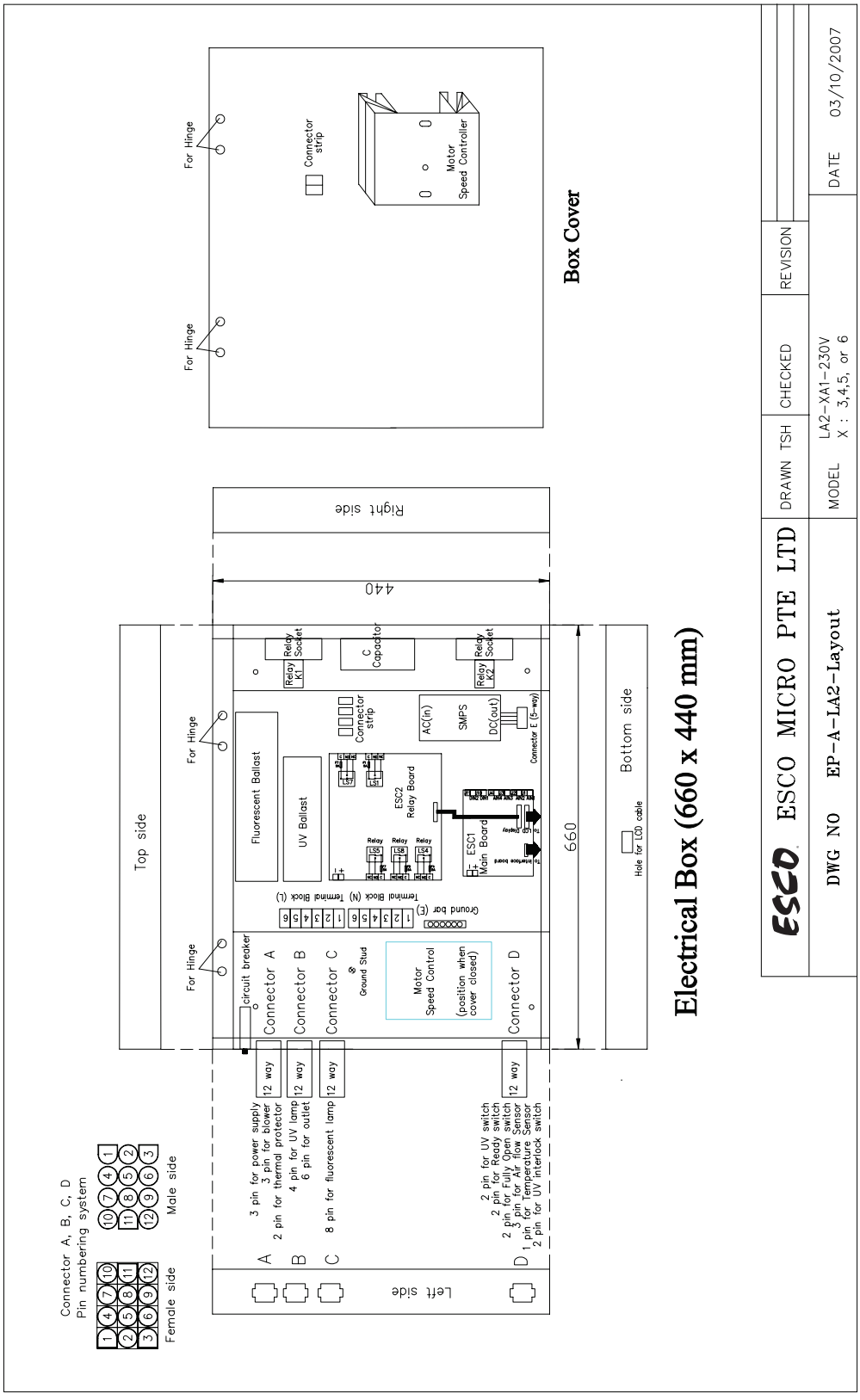


B-2

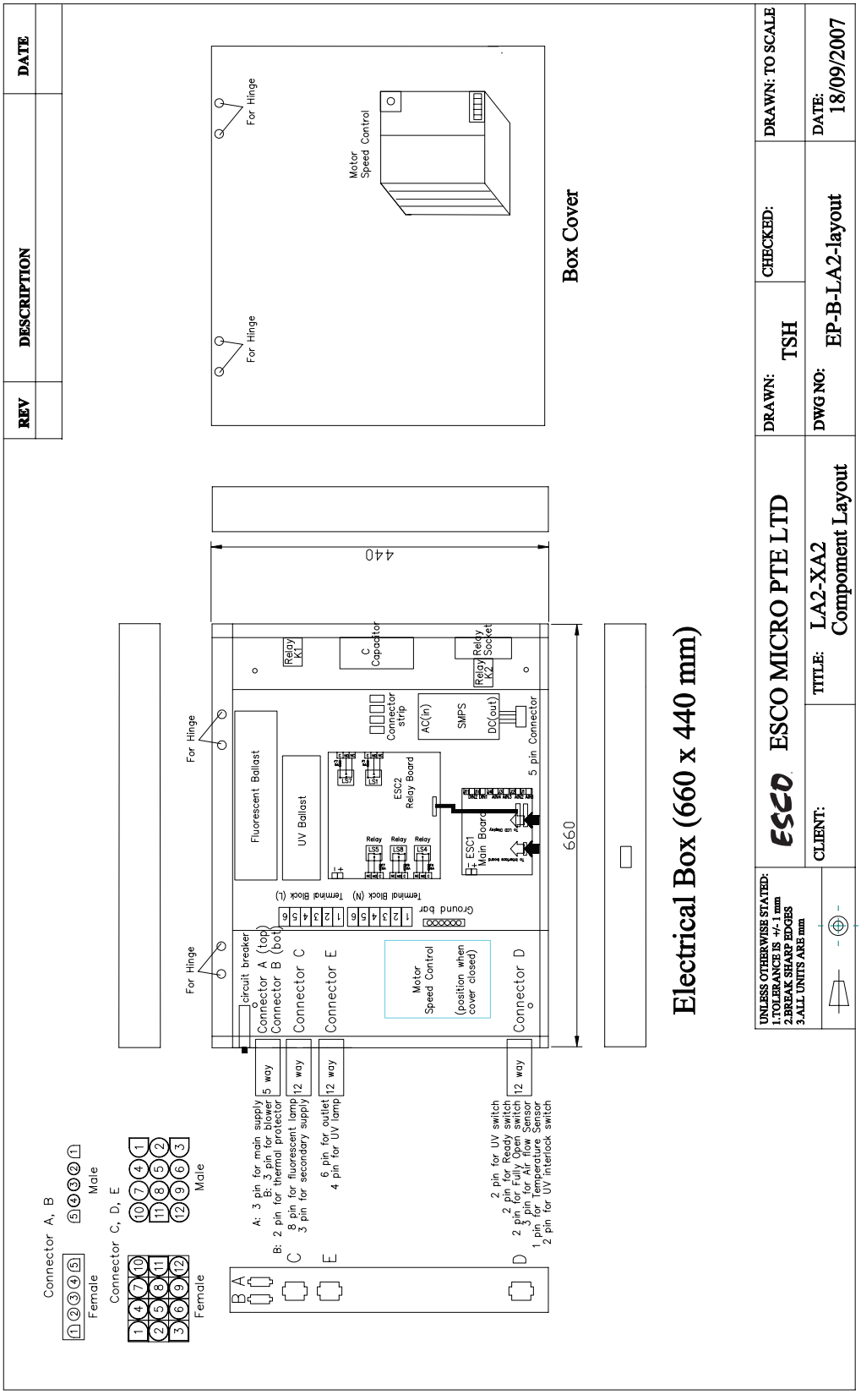
Magnetic Switch 1	***Magnetic Switch 2***	***Magnetic Switch 3***	***Magnetic Switch 4***	***Description***
Close	Open	Open	Open	Sash is fully opened, ALARM is given. ALARM can be muted.
Open	**Close**	Open	**Close**	Sash is fully closed; UV can be operated.
Open	Open	**Close**	Open	Cabinet sash is at nominal height, ready to use.
Open	Open	Open	Open	SASH is at unsafe state, ALARM is given. ALARM can not be muted.
Rest Conditions				ERR.MSWITCH detected

Table 7

ERR.CALIB	Controller has not yet been calibrated	**WARNING:** *Below steps should be carried out only by an authorized person.* • Calibrate the controller. Refer to Calibration section for details.


Box Cover
For Hinge
Connector strip
Motor Speed Controller
Electrical Box (660 x 440 mm)
Right side
440
660
Top side
Bottom side
Left side
Fluorescent Ballast
UV Ballast
ESC2 Relay Board
ESC1 Main Board
SMPS
AC(in)
DC(out)
Connector strip
Relay Socket
K1
K2
C Capacitor
Connector E (5-way)
Hole for LCD cable
circuit breaker
Connector A
Connector B
Connector C
Connector D
& Ground Stud
Motor Speed Control
(position when cover closed)
Ground bar (E)
Terminal Block (N)
Terminal Block (L)
12 way
3 pin for power supply
3 pin for blower
2 pin for thermal protector
4 pin for UV lamp
6 pin for outlet
8 pin for fluorescent lamp
2 pin for UV switch
2 pin for Ready switch
2 pin for Fully Open switch
3 pin for Air flow Sensor
1 pin for temperature Sensor
2 pin for UV interlock switch
Connector A, B, C, D
Pin numbering system
Female side
Male side
ESCO MICRO PTE LTD
DWG NO EP-A-LA2-Layout
DRAWN TSH
CHECKED
REVISION
MODEL LA2-XA1-230V
X : 3,4,5, or 6
DATE 03/10/2007

Layout A


REV
DESCRIPTION
DATE
Box Cover
For Hinge
Motor Speed Control
Electrical Box (660 x 440 mm)
440
660
Fluorescent Ballast
UV Ballast
ESC2 Relay Board
ESC1 Main Board
Relay K1
C Capacitor
Relay K2
Relay Socket
Connector strip
AC(in)
SMPS
DC(out)
5 pin Connector
Ground bar
Terminal Block (N)
Terminal Block (L)
circuit breaker
Connector A (top)
Connector B (bot)
Connector C
Connector E
Connector D
Motor Speed Control
(position when cover closed)
A: 3 pin for main supply
B: 3 pin for blower
2 pin for thermal protector
8 pin for fluorescent lamp
3 pin for secondary supply
6 pin for outlet
4 pin for UV lamp
2 pin for UV switch
2 pin for Ready switch
2 pin for Fully Open switch
3 pin for Air flow Sensor
1 pin for Temperature Sensor
2 pin for UV interlock switch
5 way
12 way
Connector A, B
Female
Male
Connector C, D, E
Female
Male
UNLESS OTHERWISE STATED:
1.TOLERANCE IS +/- 1 mm
2.BREAK SHARP EDGES
3.ALL UNITS ARE mm
CLIENT:
ESCO MICRO PTE LTD
TITLE: LA2-XA2 Compoment Layout
DRAWN: TSH
CHECKED:
DWG NO: EP-B-LA2-layout
DRAWN: TO SCALE
DATE: 18/09/2007

Layout B

2.2 OPERATION MODE SUMMARY

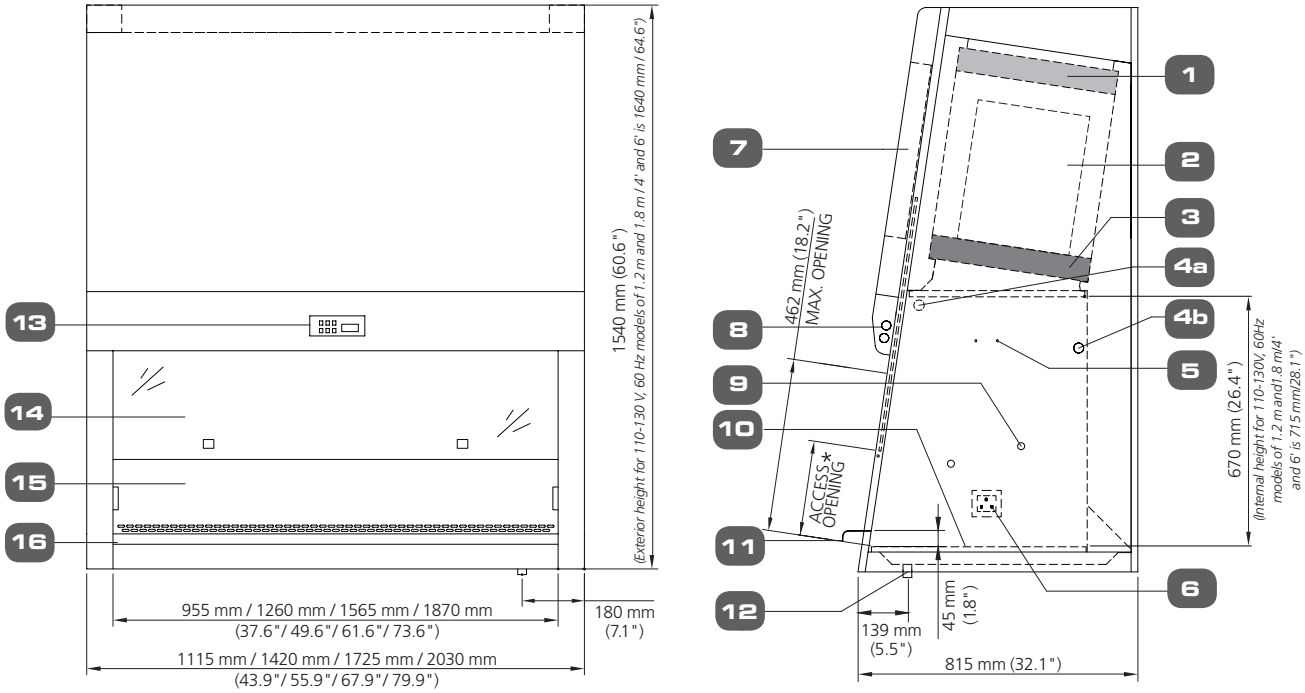
Sash Position	*Function Available*	*Normal Mode and Airfail Alarm On*	*Normal Mode and Airfail Alarm Off*	*Maintenance Mode*
READY	Sash Position Detection	Yes	Yes	No
	Fan Control	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, without WARM UP & PURGING time, no PIN required
	Light Control	Yes	Yes	Yes
	Socket Control	Yes	Yes	Yes
	UV Control	Interlocked	Interlocked	Interlocked
	MENU Access	Yes, ADMIN PIN required	Yes, ADMIN PIN required	Yes, no PIN required
	Pressing Set button	Simple Diagnostic Message	Simple Diagnostic Message	Complete Diagnostic Message
	Timer	Yes	Yes	No
	Current Time Display	Yes	Yes	No, "(!)" displayed
	Air Velocity Display	Yes	No, "FAN ON" displayed	Yes
	If not calibrated, displaying "ERR.CALIB"			
	Air Fail checking	Yes, Alarm if air fails	No	No
SASH ALARM	Sash Position Detection	Yes	Yes	Not Applicable
	Message Displayed	"SASH ALARM"	"SASH ALARM"	Not Applicable
	Current Time Display	Yes	Yes	Not Applicable
	Alarm	Yes, not mutable	Yes, not mutable	Not Applicable
	Fan Control	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, with WARM UP & PURGING time, FAN PIN required	Not Applicable
	Light Control	No	No	Not Applicable
	Socket Control	Yes	Yes	Not Applicable
	UV Control	Interlocked	Interlocked	Not Applicable

Sash Position	*Function Available*	*Normal Mode and Airfail Alarm On*	*Normal Mode and Airfail Alarm Off*	*Maintenance Mode*
FULLY OPEN	Sash Position Detection	Yes	Yes	Not Applicable
	Message Displayed	"FULLY OPEN"	"FULLY OPEN"	Not Applicable
	Current Time Display	Yes	Yes	Not Applicable
	Alarm	Yes, mutable for 5 minutes	Yes, mutable for 5 minutes	Not Applicable
	Fan Control	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, with WARM UP & PURGING time, FAN PIN required	Not Applicable
	Light Control	Yes	Yes	Not Applicable
	Socket Control	Yes	Yes	Not Applicable
	UV CONTROL	Interlocked	Interlocked	Not Applicable

UV MODE	Sash Position Detection	Yes	Yes	Not Applicable
	SWITCH OFF Fan requested	Yes	Yes	Not Applicable
	Message Displayed	"UV MODE"	"UV MODE"	Not Applicable
	Fan Control	No	No	Not Applicable
	Light Control	No	No	Not Applicable
	Socket Control	Yes	Yes	Not Applicable
	UV Control	Yes	Yes	Not Applicable

CHAPTER 3
PRODUCT SPECIFICATION

3.1 LA2 ENGINEERING DETAILS



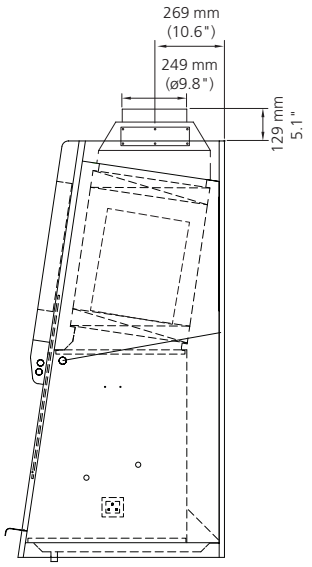
1. Exhaust ULPA filter
2. Blower
3. Downflow ULPA filter, angled

4a. UV light Retrofit Kit provision for 0.9, 1.2 and 1.5 meter (3', 4' & 5') models.

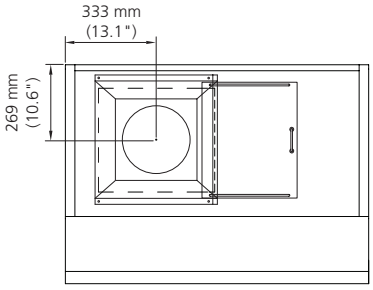
4b. UV light Retrofit Kit provision for 1.8 meter (6') models.

5. IV-Bar Retrofit Kit provision
6. Electrical outlet Retrofit Kit provision (0.9 meter / 3' model - one single outlet in workzone) (1.2, 1.5 and 1.8 meter / 4', 5' & 6' models - two single outlets in workzone)
7. Electrical / Electronics panel
8. Fluorescent lamp
9. Plugged service fixture provisions (2 on each side)
10. Stainless steel single-piece work tray
11. Stainless steel armrest
12. Drain valve Retrofit Kit provision
13. Esco Sentinel microprocessor control system
14. Safety glass sliding sash window
15. Single-piece stainless steel back wall and side walls
16. Removable side panel for plumbing access

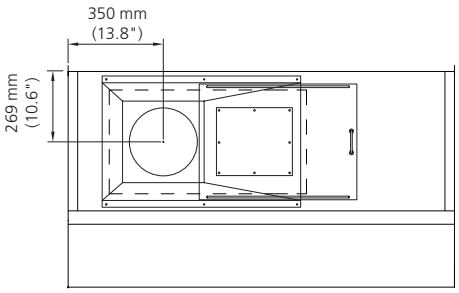
Optional Exhaust Collar Positions for Thimble-Ducting for LA2 Models



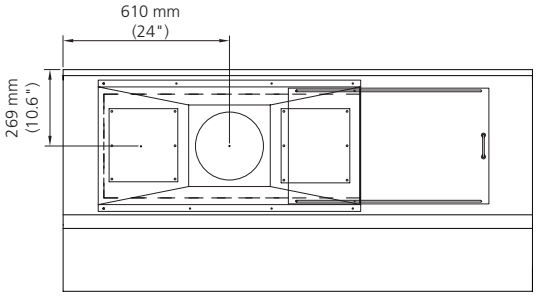
Side View - All Sizes



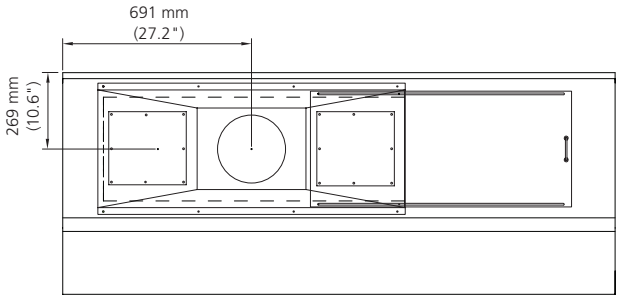
*Top View - LA2-3A_ / LA2-3L_*



*Top View - LA2-4A_ / LA2-4L_*



*Top View - LA2-5A_ / LA2-5L_*



*Top View - LA2-6A_ / LA2-6L_*

3.2 LA2 (A-SERIES) - 230 V CABINETS TECHNICAL SPECIFICATION SUMMARY

General Specifications International Models *(Europe, Asia-Pacific, Africa, Latin America / 230 V, 50 & 60 Hz)*		**LA2-3A1 LA2-3A1-M LA2-3A3 LA2-3A3-M**	**LA2-4A1 LA2-4A1-M LA2-4A3 LA2-4A3-M**	**LA2-5A1 LA2-5A1-M LA2-5A3 LA2-5A3-M**	**LA2-6A1 LA2-6A1-M LA2-6A3 LA2-6A3-M**
Nominal Size		0.9 meters (3')	1.2 meters (4')	1.5 meters (5')	1.8 meters (6')
External Dimensions (W x D x H)		1115 x 815 x 1540 mm 43.9" x 32.1" x 60.6"	1420 x 815 x 1540 mm 55.9" x 32.1" x 60.6"	1725 x 815 x 1540 mm 67.9" x 32.1" x 60.6"	2030 x 815 x 1540 mm 79.9" x 32.1" x 60.6"
Gross Internal Dimensions (W x D x H)		955 x 623 x 670 mm 37.6" x 24.5" x 26.4"	1260 x 623 x 670 mm 49.6" x 24.5" x 26.4"	1565 x 623 x 670 mm 61.6" x 24.5" x 26.4"	1870 x 623 x 670 mm 73.6" x 24.5" x 26.4"
Usable Work Area		0.45 m^2 (4.8 sq.ft.)	0.6 m^2 (6.5 sq.ft.)	0.75 m^2 (8.1 sq.ft.)	0.9 m^2 (9.7 sq.ft.)
Tested Opening		228.6 mm (9")	228.6 mm (9")	228.6 mm (9")	203.2 mm (8")
Working Opening		274 mm (10.8")	274 mm (10.8")	274 mm (10.8")	248 mm (9.8")
Average Airflow Velocity	Inflow	0.53 m/s (105 fpm)			
	Downflow	0.35 m/s (70 fpm)	0.35 m/s (70 fpm)	0.35 m/s (70 fpm)	0.33 m/s (65 fpm)
Airflow Volume	Inflow	419 m^3/ h (246 cfm)	552 m^3/ h (325 cfm)	685 m^3/ h (403 cfm)	724 m^3/ h (426 cfm)
	Downflow, 63%	702 m^3/ h (413 cfm)	924 m^3/ h (544 cfm)	1147 m^3/ h (675 cfm)	1289 m^3/ h (758 cfm)
	Exhaust, 37%	419 m^3/ h (246 cfm)	552 m^3/ h (325 cfm)	685 m^3/ h (403 cfm)	724 m^3/ h (426 cfm)
	Required Exhaust With Optional Thimble Exhaust Collar	707 m^3/ h (416 cfm)	901 m^3/ h (530 cfm)	1114 m^3/ h (656 cfm)	1256 m^3/ h (739 cfm)
ULPA Filter Typical Efficiency		>99.999% at particle size between 0.1 to 0.3 microns			
Sound Emission	NSF / ANSI 49	<66 dBA	<63.5 dBA	<66 dBA	<67 dBA
	EN 12469	<63 dBA	<60.5 dBA	<63 dBA	<64 dBA
Fluorescent Lamp Intensity		> 1230 Lux (> 114 foot-candles)	> 1400 Lux (> 130 foot-candles)	> 1070 Lux (> 100 foot-candles)	> 1225 Lux (> 114 foot-candles)
Cabinet Construction		Electrogalvanized steel with Isocide oven-baked epoxy-polyester powder coating			
		1.2 mm (0.05") / 18 gauge			
Electrical *	**220-240V, AC, 50Hz, 1Ø**	**LA2-3A1**	**LA2-4A1**	**LA2-5A1**	**LA2-6A1**
	Cabinet Power/ Amp	575W / 3.2A	720W / 3.5A	780W / 3.8A	810W / 4A
	Outlet Amp Fuse	5A	5A	5A	5A
	Total Amp	8.2A	8.5A	8.8A	9A
	BTU/ Hr	1173	1469	1591	1652
	220-240V, AC, 60Hz, 1Ø	**LA2-3A3**	**LA2-4A3**	**LA2-5A3**	**LA2-6A3**
	Cabinet Power/ Amp	575W / 3.2A	720W / 3.5A	780W / 3.8A	810W / 4A
	Outlet Amp Fuse	5A	5A	5A	5A
	Total Amp	8.2A	8.5A	8.8A	9A
	BTU/ Hr	1173	1469	1591	1652
Net Weight **		243 kg / 536 lbs	283 kg / 624 lbs	317 kg / 698 lbs	350 kg / 772 lbs
Shipping Weight **		292 kg / 644 lbs	345 kg / 761 lbs	410 kg / 904 lbs	486 kg / 1072 lbs
Shipping Dimensions, Maximum (W x D x H) **		1230 x 940 x 1900 mm 48.4" x 37" x 74.8"	1530 x 940 x 1900 mm 60.2" x 37" x 74.8"	1910 x 940 x 1900 mm 75.2" x 37" x 74.8"	2150 x 940 x 1980 mm 84.6" x 37" x 77.9"
Shipping Volume, Maximum **		2.20 m^3 (78 cu.ft.)	2.73 m^3 (97 cu.ft.)	3.41 m^3 (121 cu.ft.)	4.00 m^3 (141 cu.ft.)

* *Additional voltages may be available; contact Esco for ordering information.*
For unit with motorized window (-M), cabinet power and current consumption will be higher by 115W, 0.5A.

** *Cabinet only, excludes optional stand.*

3.3 LA2 (A-SERIES) - 115 V CABINETS TECHNICAL SPECIFICATION SUMMARY

General Specifications North America Models *(USA, Canada, Mexico / 115 V, 60 Hz)*		**LA2-3A2 LA2-3A2-M**	**LA2-4A2 LA2-4A2-M**	**LA2-5A2 LA2-5A2-M**	**LA2-6A2 LA2-6A2-M**
Nominal Size		0.9 meters (3')	1.2 meters (4')	1.5 meters (5')	1.8 meters (6')
External Dimensions (W x D x H)		1115 x 815 x 1540 mm 43.9" x 32.1" x 60.6"	1420 x 815 x 1640 mm 55.9" x 32.1" x 64.6"	1725 x 815 x 1540 mm 67.9" x 32.1" x 60.6"	2030 x 815 x 1640 mm 79.9" x 32.1" x 64.6"
Gross Internal Dimensions (W x D x H)		955 x 623 x 670 mm 37.6" x 24.5" x 26.4"	1260 x 623 x 715 mm 49.6" x 24.5" x 28.1"	1565 x 623 x 670 mm 61.6" x 24.5" x 26.4"	1870 x 623 x 715 mm 73.6" x 24.5" x 28.1"
Usable Work Area		0.45 m^2 (4.8 sq.ft.)	0.6 m^2 (6.5 sq.ft.)	0.75 m^2 (8.1 sq.ft.)	0.9 m^2 (9.7 sq.ft.)
Tested Opening		228.6 mm (9")	228.6 mm (9")	228.6 mm (9")	203.2 mm (8")
Working Opening		274 mm (10.8")	274 mm (10.8")	274 mm (10.8")	248 mm (9.8")
Average Airflow Velocity	Inflow	0.53 m/s (105 fpm)			
	Downflow	0.35 m/s (70 fpm)	0.35 m/s (70 fpm)	0.35 m/s (70 fpm)	0.33 m/s (65 fpm)
Airflow Volume	Inflow	419 m^3 / h (246 cfm)	552 m^3 / h (325 cfm)	685 m^3 / h (403 cfm)	724 m^3 / h (426 cfm)
	Downflow, 63%	702 m^3 / h (413 cfm)	924 m^3 / h (544 cfm)	1147 m^3 / h (675 cfm)	1289 m^3 / h (758 cfm)
	Exhaust, 37%	419 m^3 / h (246 cfm)	552 m^3 / h (325 cfm)	685 m^3 / h (403 cfm)	724 m^3 / h (426 cfm)
	Required Exhaust With Optional Thimble Exhaust Collar	707 m^3 / h (416 cfm)	901 m^3 / h (530 cfm)	1114 m^3 / h (656 cfm)	1256 m^3 / h (739 cfm)
ULPA Filter Typical Efficiency		>99.999% for particle size between 0.1 to 0.3 microns per IEST-RP-CC001.3			
Sound Emission	NSF / ANSI 49	<66 dBA	<64.5 dBA	<66 dBA	<67 dBA
	EN 12469	<63 dBA	<61.5 dBA	<63 dBA	<64 dBA
Fluorescent Lamp Intensity		> 1230 Lux (> 114 foot-candles)	> 1400 Lux (> 130 foot-candles)	> 1070 Lux (> 100 foot-candles)	> 1225 Lux (> 114 foot-candles)
NSF / ANSI 49 Certified		Pending	Yes	Yes	Yes
Cabinet Construction		Electrogalvanized steel with Isocide oven-baked epoxy-polyester powder coating			
		1.2 mm (0.05") /18 gauge	1.5 mm (0.06") /16 gauge	1.2 mm (0.05") /18 gauge	1.5 mm (0.06") /16 gauge
Electrical *	**110-130V, AC, 60Hz, 1Ø**	**LA2-3A2**	**LA2-4A2**	**LA2-5A2**	**LA2-6A2**
	Cabinet Power/ Amp	800W / 9A	950W / 11A	1100W / 11.5A	1200W / 11.5A
	Outlet Amp Fuse	5A	5A	5A	5A
	Total Amp	14A	16A	16.5A	16.5A
	BTU/ Hr	1632	1938	2244	2448
Net Weight **		243 kg / 536 lbs	336 kg / 741 lbs	317 kg / 698 lbs	434 kg / 957 lbs
Shipping Weight **		292 kg / 644 lbs	400 kg / 880 lbs	410 kg / 904 lbs	523 kg / 1153 lbs
Shipping Dimensions, Maximum (W x D x H) **		1230 x 940 x 1900 mm 48.4" x 37" x 74.8"	1530 x 940 x 1900 mm 60.2" x 37" x 74.8"	1910 x 940 x 1900 mm 75.2" x 37" x 74.8"	2150 x 940 x 1980 mm 84.6" x 37" x 77.9"
Shipping Volume, Maximum **		2.20 m^3 (78 cu.ft.)	2.73 m^3 (97 cu.ft.)	3.41 m^3 (121 cu.ft.)	4.00 m^3 (141 cu.ft.)

* *Additional voltages may be available; contact Esco for ordering information.*
For unit with motorized window (-M), cabinet power and current consumption will be higher by 125W, 1A.

** *Cabinet only, excludes optional stand.*

	Biosafety Cabinets	**Air Quality**	**Filtration**	**Electrical Safety**
Standards Compliance	NSF / ANSI 49, USA* EN 12469, Europe JIS K 3800, Japan SFDA YY-0569, China	ISO 14644.1, Class 3, Worldwide JIS B9920, Class 3, Japan JIS BS5295, Class 3, Japan US Fed Std 209E, Class 1 USA	EN-1822 (H14), Europe IEST-RP-CC001.3, USA IEST-RP-CC007, USA IEST-RP-CC034.1, USA	UL-C-61010A-1, USA CSA22.2, No.1010-192, Canada EN-61010-1, Europe IEC61010-1, Worldwide

3.4 LA2 (L-SERIES) TECHNICAL SPECIFICATION SUMMARY

General Specifications International Models *(Europe, Asia-Pacific, Africa, Latin America / 230 V, 50 & 60 Hz)*		**LA2-3L1 LA2-3L1-M LA2-3L3 LA2-3L3-M**	**LA2-4L1 LA2-4L1-M LA2-4L3 LA2-4L3-M**	**LA2-5L1 LA2-5L1-M LA2-5L3 LA2-5L3-M**	**LA2-6L1 LA2-6L1-M LA2-6L3 LA2-6L3-M**
Nominal Size		0.9 meters (3')	1.2 meters (4')	1.5 meters (5')	1.8 meters (6')
External Dimensions (W x D x H)	Without Base Stand	1115 x 815 x 1540 mm 43.9" x 32.1" x 60.6"	1420 x 815 x 1540 mm 55.9" x 32.1" x 60.6"	1725 x 815 x 1540 mm 67.9" x 32.1" x 60.6"	2030 x 815 x 1540 mm 79.9" x 32.1" x 60.6"
	With Base Stand (Min)	1115 x 815 x 2251 mm 43.9" x 32.1" x 88.6"	1420 x 815 x 2251 mm 55.9" x 32.1" x 88.6"	1725 x 815 x 2251 mm 67.9" x 32.1" x 88.6"	2030 x 815 x 2251 mm 79.9" x 32.1" x 88.6"
	With Base Stand (Max)	1115 x 815 x 2404 mm 43.9" x 32.1" x 94.6"	1420 x 815 x 2404 mm 55.9" x 32.1" x 96.6"	1725 x 815 x 2404 mm 67.9" x 32.1" x 96.6"	2030 x 815 x 2404 mm 79.9" x 32.1" x 96.6"
Gross Internal Dimensions (W x D x H)		955 x 623 x 670 mm 37.6" x 24.5" x 26.4"	1260 x 623 x 670 mm 49.6" x 24.5" x 26.4"	1565 x 623 x 670 mm 61.6" x 24.5" x 26.4"	1870 x 623 x 670 mm 73.6" x 24.5" x 26.4"
Usable Work Area		0.45 m^2 (4.8 sq.ft.)	0.6 m^2 (6.5 sq.ft.)	0.75 m^2 (8.1 sq.ft.)	0.9 m^2 (9.7 sq.ft.)
Tested Opening		173 mm (6.8")	173 mm (6.8")	173 mm (6.8")	173 mm (6.8")
Working Opening		218 mm (8.6")	218 mm (8.6")	218 mm (8.6")	218 mm (8.6")
Average Airflow Velocity	Inflow	0.45 m/s (90 fpm)			
	Downflow	0.30 m/s (60 fpm)	0.30 m/s (60 fpm)	0.30 m/s (60 fpm)	0.30 m/s (60 fpm)
Airflow Volume	Inflow	269 m^3/ h (158 cfm)	355 m^3/ h (209 cfm)	440 m^3/ h (259 cfm)	524 m^3/ h (308 cfm)
	Downflow, 70%	601 m^3/ h (354 cfm)	792 m^3/ h (466 cfm)	983 m^3/ h (579 cfm)	1171 m^3/ h (689 cfm)
	Exhaust, 30%	269 m^3/ h (158 cfm)	355 m^3/ h (209 cfm)	440 m^3/ h (259 cfm)	524 m^3/ h (308 cfm)
	Required Exhaust With Optional Thimble Exhaust Collar	454 m^3/ h (267 cfm)	579 m^3/ h (341 cfm)	716 m^3/ h (421 cfm)	887 m^3/ h (522 cfm)
ULPA Filter Typical Efficiency		>99.999% at particle size between 0.1 to 0.3 microns			
Sound Emission	NSF / ANSI 49	<57.5 dBA	<58.5 dBA	<59.5 dBA	<60.5 dBA
	EN 12469	<52.5 dBA	<53.5 dBA	<54.5 dBA	<55.5 dBA
Fluorescent Lamp Intensity		> 1230 Lux (> 114 foot-candles)	> 1400 Lux (> 130 foot-candles)	> 1070 Lux (> 100 foot-candles)	> 1225 Lux (> 114 foot-candles)
Cabinet Construction		Electrogalvanized steel with Isocide oven-baked epoxy-polyester powder coating			
		1.2 mm (0.05") / 18 gauge			
Electrical *	**220-240V, AC, 50Hz, 1Ø**	**LA2-3L1**	**LA2-4L1**	**LA2-5L1**	**LA2-6L1**
	Cabinet Power/ Amp	575W / 3.2A	720W / 3.5A	780W / 3.8A	810W / 4A
	Outlet Amp Fuse	5A	5A	5A	5A
	Total Amp	8.2A	8.5A	8.8A	9A
	BTU/ Hr	1173	1469	1591	1652
	220-240V, AC, 60Hz, 1Ø	**LA2-3L3**	**LA2-4L3**	**LA2-5L3**	**LA2-6L3**
	Cabinet Power/ Amp	575W / 3.2A	720W / 3.5A	780W / 3.8A	810W / 4A
	Outlet Amp Fuse	5A	5A	5A	5A
	Total Amp	8.2A	8.5A	8.8A	9A
	BTU/ Hr	1173	1469	1591	1652
Net Weight **		243 kg / 536 lbs	283 kg / 624 lbs	317 kg / 698 lbs	350 kg / 772 lbs
Shipping Weight **		292 kg / 644 lbs	345 kg / 761 lbs	410 kg / 904 lbs	486 kg / 1072 lbs
Shipping Dimensions, Maximum (W x D x H) **		1230 x 940 x 1900 mm 48.4" x 37" x 74.8"	1530 x 940 x 1900 mm 60.2" x 37" x 74.8"	1910 x 940 x 1900 mm 75.2" x 37" x 74.8"	2150 x 940 x 1980 mm 84.6" x 37" x 77.9"
Shipping Volume, Maximum **		2.20 m^3 (78 cu.ft.)	2.73 m^3 (97 cu.ft.)	3.41 m^3 (121 cu.ft.)	4.00 m^3 (141 cu.ft.)

* *Additional voltages may be available; contact Esco for ordering information.*
For unit with motorized window (-M), cabinet power and current consumption will be higher by 115W, 0.5A.

** *Cabinet only, excludes optional stand.*

	Biosafety Cabinets	Air Quality	Filtration	Electrical Safety
Standards Compliance	EN 12469, Europe	ISO 14644.1, Class 3, Worldwide JIS B9920, Class 3, Japan JIS BS5295, Class 3, Japan US Fed Std 209E, Class 1 USA	EN-1822 (H14), Europe IEST-RP-CC001.3, USA IEST-RP-CC007, USA IEST-RP-CC034.1, USA	UL-C-61010A-1, USA CSA22.2, No.1010-192, Canada EN-61010-1, Europe IEC61010-1, Worldwide

3.10 ENVIRONMENTAL AND ELECTRICAL REQUIREMENTS

The cabinet has been designed to be used under the following conditions:

Environment Requirements			
	US	Europe / Asia	Australia
Situation	Indoor Use Only		
Relative Humidity	20% - 90%		
Altitude	Up to 2000 meters (6600 ft)		
Temperature	Temperature should be in between 20 degrees C and 30 degrees C (68 deg F and 86 deg F)		
Pollution Degree	2.0 *		

** Pollution degree describes the amount of conductive pollutants present in an operating environment. In Pollution degree 2, it is assumed that only non-conductive pollutants such as dust are present, except that occasional conductivity is caused by condensation.*

Electrical Requirements		
	US	Europe / Asia / Australia
Power Rating	110-130 V AC 60Hz	220-240V AC 50Hz
Power Source	Dedicated with unobstructed access	
Maximum Voltage Fluctuation	+/- 2% of nominal voltage otherwise install a power stabilizer	
Installation Category	Category II **	
Surge Protection and UPS	Strongly recommended for better protection	
Leakage Current	All electrical outlets combined should not exceed 2.0mA	
Voltage dips & short interruptions immunity test	At the time of carrying out the 'Voltage dips & short interruptions immunity test', flickers were observed in the fluorescent light whenever the voltage dips and short interruptions were applied on the AC mains port of the unit. This condition got rectified automatically after the test. The unit is considered to meet performance criteria B in 'Voltage dips & short interruptions immunity test' based on the above observation.	

*** Installation category (over voltage category) defines the level of transient over voltage that the instrument is designed to withstand safely. It depends on the nature of electricity supply and the cabinet's over voltage protection means. CAT II is a category used for instruments which can be plugged to a power point which is comparable to the public mains found in facilities such as hospitals, research laboratories and industrial laboratories. The expected transient over voltage in CAT II is 2500V for a 230V supply and 1500V for a 120V supply.*

REPLACEMENT PARTS LIST (STANDARD)

The use of non-Esco parts and / or parts not supplied directly by Esco or our authorized distributors, including but not limited to spare parts, system components and / or system accessories, shall void all expressed or implied warranties.

NO	ITEM/CABINET MODEL	ITEM CODE	DESCRIPTION	QTY
MECHANICAL REPLACEMENT PARTS				
1	**FILTER** *(For units manufactured in Jan 04 onwards. Units made before Jan 04, please contact Esco Singapore with Serial number)*			
	LA2-3A1/A2/A3/L1/L3	EQR/SP-FTR-040	ULPA FILTER NO. 40 (DOWNFLOW)	1
		EQR/SP-FTR-041	ULPA FILTER NO. 41 (EXHAUST)	1
	LA2-4A1/A2/A3/L1/L3	EQR/SP-FTR-031	ULPA FILTER NO. 31 (DOWNFLOW)	1
		EQR/SP-FTR-032	ULPA FILTER NO. 32 (EXHAUST)	1
	LA2-5A1/A2/A3/L1/L3	EQR/SP-FTR42	ULPA FILTER NO. 42 (DOWNFLOW)	1
		EQR/SP-FTR43	ULPA FILTER NO. 43 (EXHAUST)	1
	LA2-6A1/A2/A3/L1/L3	EQR/SP-FTR44	ULPA FILTER NO. 44 (DOWNFLOW)	1
		EQR/SP-FTR45	ULPA FILTER NO. 45 (EXHAUST)	1
2	**BLOWER**			
	LA2-_A1/A3/L1/L3	EQR/EL-BLOWER-7	BLOWER CENTRIFUGAL NO. 7	1
	LA2-_A2	EQR/EL-BLOWER-8	BLOWER CENTRIFUGAL NO. 8	1
3	**GLASS (SASH WINDOW)**			
	LA2-3A1/A3/L1/L3	EQR/GL-71	LAMINATED GLASS GL-71	1
	LA2-4A1/A3/L1/L3	EQR/GL-61	LAMINATED GLASS GL-61	1
	LA2-6A1/A3/L1/L3	EQR/GL-73	LAMINATED GLASS GL-73	1
	LA2-3A2	EQR/GL-152	TEMPERED SAFETY GLASS GL-152	1
	LA2-4A2	EQR/GL-153	TEMPERED SAFETY GLASS GL-153	1
	LA2-6A2	EQR/GL-154	TEMPERED SAFETY GLASS GL-154	1
4	**GAS SPRING**			
	LA2-3A1/A2/A3//L1/L3, LA2-4A1/A2/A3//L1/L3	EQR/ME-GSPRING-19	GAS SPRING NO. 19	2
	LA2-6A1/A2/A3//L1/L3	EQR/ME-GSPRING-12	GAS SPRING NO. 12	2
ELECTRICAL REPLACEMENT PARTS				
1	**ELECTRICAL MODULE**			
	LA2-_A1/A3/L1/L3	EPA1-H10	COMPLETE ELECTRICAL PANEL 220-240V, AC EPA1 WITH SPEED CONTROLLER 10A	1
	LA2-_A2	EPB-SL5	ELECTRICAL PANEL EPB WITH SPEED CONTROL PCSL5H	1
1.1	**SPEED CONTROL**			
	LA2-_A1/A3/L1/L3	EQR/EL-KH706-0155-065	SPEED CONTROLLER 10A	1
	LA2-_A2	EQR/EL-INFITEC-PCSL5H	SPEED CONTROLLER PCSL5H	1
1.2	**UV BALLAST**			
	LA2-3A1/A3/L1/L3	EQR/EL-BAL-EBP15	UV BALLAST	1
	LA2-4A1/A3/L1/L3, LA2-6A1/A3/L1/L3	EQR/EL-BAL-EBP30	UV BALLAST	1
	LA2-3A2, LA2-4A2, LA2-6A2	EQR/EL-BAL-EBU120	UV BALLAST	1
1.3	**BALLAST***			
	LA2-_A1/A3/L1/L3	EQR/EL-BAL-UNV-T8-IS	ELECTRONIC BALLAST	1
	LA2-_A2	EQR/EL-BAL-TP432IS	ELECTRONIC BALLAST	1

1.4	**RELAY***			
	LA2-_A1/A3/L1/L3	EQR/EL-REL-JQX220V	RELAY 230V	1
	LA2-_A2	EQR/EL-REL-JQX30A	RELAY 110V	1
	LA2-_A1/A2/A3//L1/L3	EQR/EL-REL-JQX12VD	RELAY 12V	1
2	**AIRFLOW ALARM AND CONTROL SYSTEM**			
2.1	**MEMBRANE**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-06F	MEMBRANE CLASS II BIOHAZARD (C SERIES DRAFT 8)	1
2.2	**MAINBOARD** *(For units manufactured from May 04 onwards)*			
	LA2-_A1/A3/L1/L3	EQR/EL-MC-18	MAIN BOARD (C-SERIES)	1
	LA2-_A2	EQR/EL-MC-01	MAIN BOARD (PCA SENTINEL C SERIES) REV C	
2.3	**RELAY BOARD**			
	LA2-_A1/A3/L1/L3	EQR/EL-MC-19	5 RELAY BOARD (C-SERIES)	1
	LA2-_A2	EQR/EL-MC-02	5-RELAY BOARD	1
2.3.1	**FUSE**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-FUSE-F5AL250V	5A QUICK ACTING F5AL250V FUSE	5
2.4	**INTERFACE BOARD**			
	LA2-_A1/A3/L1/L3	EQR/EL-MC-20	INTERFACE BOARD (C-SERIES)	1
	LA2-_A2	EQR/EL-MC-03	INTERFACE BOARD (C SERIES INTERFACE) REV B	1
2.5	**LCD**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-34	16 CHARACTERS X 1 LINE LCD MODULE WITH BACKLIT	1
2.6	**SMPS**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-22	SMPS	1
2.7	**AIRFLOW SENSOR** *(For units manufactured from July 05 onwards)*			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-SA-B2	AIR FLOW SENSOR	1
2.8	**TEMPERATURE SENSOR**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-SA-TEMP	TEMPERATURE SENSOR	1
3	**CAPACITOR**			
	LA2-_A1/A3/L1/L3	EQR/EL-CCAP-14MF	CBB 60 TYPE MOTOR RUN CAPACITOR, 400V, 14 MF	1
	LA2-_A2	EQR/EL-CCAP-40MF	CBB 60 CAPACITOR	1
4	**FLUORESCENT TUBE**			
	LA2-3A1/A2/L1, LA2-6A1/A2	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 3FT	2
	LA2-4A1/A2/A3/L1/L3	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 4FT	2
5	**UV TUBE**			
	LA2-3A1/A2/A3/L1/L3	EQR/EL-TUB-UV15F15W	UV TUBE 1.5FT	1
	LA2-4A1/A2/A3/L1/L3, LA2-6A1/A2/A3/L1/L3	EQR/EL-TUB-UV3F30W	UV TUBE 3FT	1
6	**CIRCUIT BREAKER**			
	LA2-3A1/A3/L1/L3, LA-4A1/A3/L1/L3	EQR/EL-CB-10A	CIRCUIT BREAKER 10AMPS, WITH KURL NUT	1
	LA2-3A2, LA2-4A2, LA2-6A2	EQR/EL-CB-16A	CIRCUIT BREAKER 16AMPS, WITH KURL NUT	1

7	**MAGNETIC SWITCH** *(For units manufactured from Jan 05 onwards. Microswitch was replaced then.)*			
	LA2-_A2	EQR/EL-MC-BS2011-UL	MAGNETIC CONTACT WITH UL LOGO	3
8	**MAGNETIC**			
	LA2-_A2	EQR/EL-MC-MAGNETIC	MAGNETIC 10 X 20 X 3.5 MM THK, WITH 3 M TYPE	3

Notes:

1) Please indicate Serial Numbers upon ordering the parts to replace.

2) On every order of glass and filters, additional nominal fee will be charged on fumigated crate.

REPLACEMENT PARTS LIST (MOTORIZED WINDOW)

The use of non-Esco parts and / or parts not supplied directly by Esco or our authorized distributors, including but not limited to spare parts, system components and / or system accessories, shall void all expressed or implied warranties.

NO	ITEM/CABINET MODEL	ITEM CODE	DESCRIPTION	QTY
MECHANICAL REPLACEMENT PARTS				
1	**FILTER**			
	LA2-3A1/A2/A3/L1/L3	EQR/SP-FTR-040	ULPA FILTER NO. 40 (DOWNFLOW)	1
		EQR/SP-FTR-041	ULPA FILTER NO. 41 (EXHAUST)	1
	LA2-4A1/A2/A3/L1/L3	EQR/SP-FTR-031	ULPA FILTER NO. 31 (DOWNFLOW)	1
		EQR/SP-FTR-032	ULPA FILTER NO. 32 (EXHAUST)	1
	LA2-5A1/A2/A3/L1/L3	EQR/SP-FTR-031	ULPA FILTER NO. 31 (DOWNFLOW)	1
		EQR/SP-FTR-032	ULPA FILTER NO. 32 (EXHAUST)	1
	LA2-6A1/A2/A3/L1/L3	EQR/SP-FTR44	ULPA FILTER NO. 44 (DOWNFLOW)	1
		EQR/SP-FTR45	ULPA FILTER NO. 45 (EXHAUST)	1
2	**BLOWER**			
	LA2-_A1/A3/L1/L3	EQR/EL-BLOWER-7	BLOWER CENTRIFUGAL NO.7	1
	LA2-_A2	EQR/EL-BLOWER-8	BLOWER CENTRIFUGAL NO.8	1
3	**GLASS (SASH WINDOW)**			
	LA2-3A1/A3/L1/L3	EQR/GL-71	LAMINATED GLASS GL-71	1
	LA2-4A1/A3/L1/L3	EQR/GL-61	LAMINATED GLASS GL-61	1
	LA2-6A1/A3/L1/L3	EQR/GL-73	LAMINATED GLASS GL-73	1
	LA2-3A2	EQR/GL-152	TEMPERED SAFETY GLASS GL-152	1
	LA2-4A2	EQR/GL-153	TEMPERED SAFETY GLASS GL-153	1
	LA2-6A2	EQR/GL-154	TEMPERED SAFETY GLASS GL-154	1
4	**GAS SPRING**			
	LA2-3A1/A2/A3/L1/L3, LA2-4A1/A2/A3/L1/L3	EQR/ME-GSPRING-19	GAS SPRING NO. 19	2
	LA2-6A1/A2/A3/L1/L3	EQR/ME-GSPRING-12	GAS SPRING NO. 12	2
5	**TUBULAR MOTOR**			
	LA2-_A1/A3/L1/L3	EQR/ME-TBR-MOTOR-220	TUBULAR MOTOR 220V	1
	LA2-_A2	EQR/ME-TBR-MOTOR-110	TUBULAR MOTOR 110V	1
ELECTRICAL REPLACEMENT PARTS				
1	**ELECTRICAL MODULE**			
	LA2-_A1/A3/L1/L3	EPA-LA2-M	ELECTRICAL PANEL 220-240V, AC EP-A-LA2-M WITH SPEED CONTROLLER 10A	1
	LA2-_A2	EPB-LA2-M	ELECTRICAL PANEL 110-130V, AC EP-B-LA2-M WITH SPEED CONTROL PCSL5H	1
1.1	**SPEED CONTROL**			
	LA2-_A1/A3/L1/L3	EQR/EL-KH706-0155-065	SPEED CONTROLLER 10A	1
	LA2-_A2	EQR/EL-INFITEC-PCSL5H	SPEED CONTROLLER PCSL5H	1
1.2	**UV BALLAST**			
	LA2-3A1/A3	EQR/EL-BAL-EBP15	UV BALLAST	1

	LA2-4A1/A3/L1/L3, LA2-5A1/A3/L1/L3, LA2-6A1/A3/L1/L3	EQR/EL-BAL-EBP30	UV BALLAST	1
	LA2-3A2, LA2-4A2, LA2-5A2, LA2-6A2	EQR/EL-BAL-EBU120	UV BALLAST	1
1.3	**BALLAST***			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-BAL-UNV-T8-IS	ELECTRONIC BALLAST	1
1.4	**RELAY***			
	LA2-_A1/A3/L1/L3	EQR/EL-REL-JQX220V	RELAY 230V	1
	LA2-_A2	EQR/EL-REL-JQX30A	RELAY 110V	1
2	**AIRFLOW ALARM AND CONTROL**			
2.1	**MEMBRANE**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-06F	MEMBRANE CLASS II BIOHAZARD (C SERIES DRAFT 8)	1
2.2	**MAINBOARD**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-18	MAIN BOARD (C-SERIES)	1
2.3	**RELAY BOARD**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-19A	7-RELAY RELAY BOARD (C-SERIES)	1
2.3.1	**FUSE**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-FUSE-F5AL250V	5A QUICK ACTING F5AL250V FUSE	7
2.4	**INTERFACE BOARD**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-20	INTERFACE BOARD (C-SERIES)	1
2.5	**LCD**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-34	16 CHARACTERS X 1 LINE LCD MODULE WITH BACKLIT	1
2.6	**SMPS**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-22	SMPS	1
2.7	**AIRFLOW SENSOR**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-SA-B2	AIR FLOW SENSOR Rev B2	1
2.8	**TEMPERATURE SENSOR**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-SA-TEMP	TEMPERATURE SENSOR	1
3	**CAPACITOR**			
	LA2-_A1/A3/L1/L3	EQR/EL-CCAP-14MF	CBB 60 Type motor run capacitor, 400V, 14 mf	1
	LA2-_A2	EQR/EL-CCAP-40MF	CBB 60 CAPACITOR	1
4	**FLOURESCENT TUBE**			
	LA2-3A1/A2/A3/L1/L3	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 3FT	2
	LA2-4A1/A2/A3/L1/L3	EQR/EL-TUB-4F32W	FLUORESCENT TUBE 4FT	2
	LA2-5A1/A2/A3/L1/L3	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 3FT	2
		EQR/EL-TUB-2F17W	FLUORESCENT TUBE 2FT	2
	LA2-6A1/A2/A3/L1/L3	EQR/EL-TUB-3F25W	FLUORESCENT TUBE 3FT	4
5	**UV TUBE**			
	LA2-3A1/A2/A3/L1/L3	EQR/EL-TUB-UV15F15W-C	UV TUBE 1.5FT	1
	LA2-4A1/A2/A3/L1/L3, LA2-5A1/A2/A3/L1/L3, LA2-6A1/A2/A3/L1/L3	EQR/EL-TUB-UV3F30W-C	UV TUBE 3FT	1

6	**CIRCUIT BREAKER**			
	LA2-3A1/A3/L1/L3, LA2-4A1/A3/L1/L3, LA2-5A1/A3/L1/L3, LA2-6A1/A3/L1/L3	EQR/EL-CB-4	CIRCUIT BREAKER 10AMPS, WITH KURL NUT	1
	LA2-3A2, LA2-4A2, LA2-5A2, LA2-6A2	EQR/EL-CB-5	CIRCUIT BREAKER 16AMPS, WITH KURL NUT	1
7	**MAGNETIC SWITCH**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-BS2011-UL	MAGNETIC CONTACT WITH UL LOGO	4
8	**MAGNETIC**			
	LA2-_A1/A2/A3/L1/L3	EQR/EL-MC-MAGNETIC	MAGNETIC 10 X 20 X 3.5 MM THK, WITH 3 M TYPE	2

APPENDIX

APPENDIX A
FURTHER INFORMATION AND REFERENCE MATERIALS

The following documents are available for download at www.escoglobal.com, in the Technical Support area. These documents have been selected as pertinent to this product and we would recommend that anyone operating the cabinet familiarize themselves with this information.

1. INTRODUCTION TO BIOHAZARD SAFETY CABINET
2. BIOLOGICAL SAFETY LEVELS CLASSIFICATION
3. KI-DISCUS TEST
4. ULTRAVIOLET LAMPS IN LAMINAR FLOW AND BIOLOGICAL SAFETY CABINETS
5. EXHAUST DUCTED CLASS II, TYPE A2 SAFETY CABINETS

FILTRATION TECHNOLOGY

Introduction to Contamination Control and Cleanroom Technology. 2000. Matt Ramstorp. Wiley-VCH. Weinheim.

Cleanroom Technology. Fundamentals of Design, Testing, and Operation. 2001. Whyte.W. Wiley, West Sussex, England.

*IEST-RP-CC001: HEPA and ULPA Filters.*2002. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-RP-CC007: Testing ULPA Filters.*2002. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-RP-CC021: Testing HEPA and ULPA Filter Media.*2002. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-RP-CC034: HEPA and ULPA Filter Leak Tests.*2002. Institute of Environmental Sciences and Technology, Illinois, USA.

BS EN 13091: Biotechnology. Performance Criteria for Filter Elements and Filtration Assemblies. 2000. British Standards, UK.

CLEAN AIR TECHNOLOGY

ISO 14644: Cleanrooms and Controlled Environments.2000. International Organization for Standardization, Switzerland.

*IEST-G-CC1001: Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones.*1999. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-G-CC1002: Determination of the Concentration of Airborne Ultrafine Particles.*1999. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-G-CC1003: Measurement of Airborne Macro Particles.*1999. Institute of Environmental Sciences and Technology, Illinois, USA.

*IEST-G-CC1004: Sequential Sampling Plan for Use in Classification of the Particulate Cleanliness of Air in Cleanrooms and Clean Zones.*1999. Institute of Environmental Sciences and Technology, Illinois, USA.

BIOLOGICAL SAFETY

BS EN 12741: Biotechnology. Laboratories for Research, Development, and Analysis. Guidance for Biotechnology Laboratory Operations. 1999. British Standards, UK.

BS EN 12128: Biotechnology. Laboratories for Research, Development, and Analysis. Containment Levels of Microbiology Laboratories, Areas of Risk, Localities, and Physical Safety Requirements. 1998. British Standards, UK.

*Anthology of Biological safety I. Perspectives on Laboratory Design.*1999. Richmond, J.Y., American Biological Safety Association. Illinois, USA.

*Anthology of Biological safety II. Facility Design Consideration.*1999. Richmond, J.Y., American Biological Safety Association. Illinois, USA.

*Anthology of Biological safety III. Application of Principles.*1999. Richmond, J.Y., American Biological Safety Association. Illinois, USA.

SAFETY CABINETS

BS EN 12469: Biotechnology. Performance Criteria for Microbiological Safety Cabinet. 2000. British Standards, UK.

BS EN 12296: Biotechnology. Equipment. Guidance on Testing Procedures for Cleanability. 1998. British Standards, UK.

BS EN 12297: Biotechnology. Equipment. Guidance on Testing Procedures for Sterilizability. 1998. British Standards, UK.

BS EN 12298: Biotechnology. Equipment. Guidance on Testing Procedures for Leak Tightness. 1998. British Standards, UK.

National Sanitation Foundation Standard Number 49 for Class II (Laminar Flow) Biohazard Cabinetry. 2002. National Sanitation Foundation, Michigan, USA.

AS2252.2: Class II Biological Safety Cabinets. 1994. Australia.

AS2567: Cytotoxic Drug Safety Cabinets. 1994. Australia.

AS2639: Cytotoxic Drug Safety Cabinets. Installation and Use. 1994. Australia.

AS2647: Biological Safety Cabinets. Installation and Use. 1994. Australia.

*JIS K3800: Class II Biological Safety Cabinets.*2000. Japan.

SABS 0226: Installation, Post-Installation Tests and Maintenance of Microbiological Safety Cabinets. 2001. South Africa.

WEBSITES

1. www.escoglobal.com
   Esco Micro Pte. Ltd.
2. www.nsf.org
   NSF International
3. http://www.hc-sc.gc.ca/hpb/lcdc/biosafty/docs/index.html
   Health Canada - Laboratory Biological safety Guidelines
4. http://www.cdc.gov/od/ohs/biosfty/bsc/bsc.htm
   Centre for Disease Control – Primary Containment for Biohazards
5. http://www.cdc.gov/od/ohs/biosfty/bmbl4/bmbl4toc.htm
   Centre for Disease Control – Office of Health and Safety – Biological safety in Microbiological and Biomedical Laboratories
6. http://www.osha.gov
   Occupational Safety and Health Administration, USA
7. http://www.absa.org
   American Biological Safety Association
8. http://www.cetainternational.org and
   http://www.cetainternational.org/links.htm
   Controlled Environment Testing Association and Related Links

APPENDIX B
LOG RECORD

Installed By:

Date : _____ Cabinet Model: _____

Company: _____ Serial Number: _____

Responsible Person: _____

1. This log record should be used by the operator to record any new agents / bacteria / viruses that has been introduced to the cabinet during its operation, problems encountered, etc.
2. Any decontamination procedure performed by either the user or the technician should be recorded down as well.
3. Please also record any major maintenance procedure performed by the service technician, for example: filter changing, recertification, UV lamp replacement, etc.

Date	Event	User signature	Supervisor signature

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